Appendix D-VII

THERMAL METAL WASH (TMW) SYSTEM TRIAL BURN PLAN

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THERMAL METAL WASH (TMW) SYSTEM TRIAL BURN PLAN

A. INTRODUCTION

The primary purpose of this test plan is to establish the basis to conduct trial and risk burn testing of the thermal metal wash (TMW) system operated by Rineco. All information relating to such testing of the system, inclusive of the system control device, has been prepared in relation to APC&EC Regulation 23 §270.62(b) (Hazardous waste incinerator permits), or as directed by Arkansas Department of Environmental Quality (ADEQ). Of note, although the test plan has been prepared in relation to regulations applicable to trial burn testing of hazardous waste incinerator (combustion) units or as directed, the TMW is neither a combustion device nor is it operated as such.

In addition, the trial burn test plan incorporates provisions for generating data and information in support of multi-pathway, site specific assessments described in the Risk Burn Guidance for Hazardous Waste Combustion Facilities, OSWER, EPA530-R-01-001, July 2001 and the Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, OSWER, EPA-R-05-006, September 2006. As such, where trial burn (TB) is referenced herein, it has been prepared and will also be conducted consistent with the direction by ADEQ for conductance of 'Risk Burn' testing to obtain the necessary information to carry out the stated multi-pathway, site specific assessments.

Detailed TMW performance data will be generated as a result of conducting the trial burn. Such data will be provided in the TB report to document the capacity of the unit(s) in compliance with applicable regulatory controls for such miscellaneous units.

Prior to testing Rineco will prepare a spike feed mixture representative of the maximum design feed rate managed in the system. All sampling and analysis for determinations of constituent concentrations in stack gas will be conducted by independent entities.

After successful completion of the TMW testing, Rineco will prepare and submit to ADEQ: (1) a complete trial burn report and, upon determination based on approved screening methods, (2) a site-specific health risk assessment report. The health risk assessment report will be developed with specific focus on documenting parameter levels as referenced in the documents referenced above. Additionally, preparation of the risk assessment report will follow as applicable under the most current Screening Level Risk Assessment Protocols.

B. THERMAL METAL WASH TRIAL BURN (TB) PLAN

B-1 Trial Burn Objectives

This test plan provides the details for execution of the trial burn to meet the applicable regulatory compliance requirements that can be considered relevant to the facility, or as directed by ADEQ. EPA guidance documents, including the EPA Region VI guidance document "Hazardous Waste Combustion Unit Permitting Manual," January 1998, were referenced to write this TB plan.

The primary objectives for the trial burn are as follows:

1) Demonstrate that particulate matter emissions do not exceed 0.013 grains per dry standard cubic foot (gr/dscf) corrected to 7% oxygen, dry basis.

2) Demonstrate that metal emissions do not exceed the following emissions standards: Mercury at 130 µgm/dscm; The sum of Cadmium + Lead at 230 µgm/dscm; The sum of Arsenic + Beryllium + Chromium at 92 µgm/dscm. All emissions levels will be corrected to 7% oxygen, dry basis.

3) Identify and quantify products of incomplete combustion (PICs) in relation to carbon monoxide and total hydrocarbon levels corrected to 7% oxygen over an hourly rolling average, for subsequent use in the site-specific assessment.

4) Quantify emissions of HCl and chlorine (Cl_2) gas for subsequent use in the site-specific assessment.

5) Attempt to quantify the maximum metals emission limitations for subsequent use in the site-specific assessment, in micrograms per dry standard cubic meter (ug/dscm). All metal emissions will be corrected to 7% oxygen, dry basis.

6) Determine the dioxin/furan emission rates, in nanograms Toxicity Equivalence Quotient (TEQ) per dry standard cubic meter (ng/dscm) corrected to 7% oxygen, dry basis for subsequent use in the site-specific assessment.

7) Generate the necessary data as specified herein to facilitate the submittal of the site-specific assessment report following the current protocols.

8) Confirm that the TMW operation is adequately protective of public health and the environment through the site-specific assessment.

B-2 Trial Burn General Approach

The purpose of the TB is to accomplish the objectives identified in Section B-1 and verify the capability of the TMW to meet applicable regulatory risk based performance standards. During all trial burn activities Rineco will operate all process equipment associated with the TMW system.

Rineco is currently scheduling a single test condition, that being operation of the thermal metal wash control device (Thermal Oxidation Unit TOU-102) under low temperature test condition (~ 1500°F). A minimum of three valid test runs is required for the various sample methods to be employed. Rineco anticipates utilizing a custom feed mixture designed to be measureable as well as a balance between metals and bulk content, and to document the ability of the system to control pollutants of concern. The TMW is anticipated to be operated in a manner that will ensure maximum throughput of the design feed through the system.

During all the requisite runs, samples of feed materials, solid and liquid residuals generated as well as stack gas will be accomplished. TMW standard operational data will also be generated during testing.

Once the three test runs for the test condition are validated, the resulting data will be used in the TB Report. If any test run is not executed under steady-state conditions, or if data is lost or compromised in any way, then the results of that test run may or may not be included in the TB report. If a test run is not finished, then the abandoned test run will not be integrated into the TB report. If a test run is completed and the data is lost or compromised, then the available results will be included in the Rineco TB report. An additional run to replace the suspect run may be executed. Rineco, with concurrence of the regulatory agency, will make a determination as to the severity of the lost or compromised data to determine whether an additional test run needs to be performed for the condition.

C. DETAILED ENGINEERING DESCRIPTION

The Rineco Thermal Metal Wash (TMW)[1] system is not a hazardous waste combustion unit as defined under Federal or state laws, rules and regulations. Rather, the TMW is designed to process hazardous waste through indirect heat transfer in a two stage system in order to accomplish separation of solid waste for the collection of scrap metal for recycle. Other residual materials are also recovered and transferred to covered containers for appropriate management. Non-condensable vapors from the process are collected in a closed-vent system and routed to a vapor incinerator control device (thermal oxidation unit) for emissions control. Only at the control device are residual vapors from the process subjected to elevated temperature and oxygen conditions necessary for combustion.

The TMW system is essentially comprised of ten (10) elements. These operations are depicted in Figures 029A, 029B and 029C of the part B application. The nine elements include the following:

1) Loading hopper & screw feeders
2) Airlock Chambers
3) Heating screws
4) Cooling screws
5) Chain conveyor and deck screen

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[1] The Rineco Thermal Metal Wash (TMW) system most closely meets the definition of a process vent under APC&EC Regulation 264.1031 Definitions, specifically a thin-film evaporation operation. Such units are further described in EPA's hazardous waste guidance documents EPA-45/3-89-021, Section 5.1.2 Thin-Film Evaporation. Rineco additionally utilizes condensation for removal of vapors to the extent practicable. Final air pollution control is provided through an accompanying control device that meets the definition of vapor incinerator under the same referenced definitions.

6) Magnetic separators
7) Venturi scrubbers
8) Heat exchangers
9) Collection tank
10) Closed vent system and control device

Available equipment specifications for this equipment are provided in Table C-1, Detailed Engineering Description that follows. The following provides a general description of the system operation.

C-1 Loading Hood & Screw Feeders

Material to be separated is added to the TMW via the enclosed loading hood and hopper located above the feed screws. The loading hood uses a mechanically operated door with seals to maintain a sealed enclosure over the screw conveyor head space as materials are introduced into the TMW. Any vapors that may be present are conveyed to the control device by the flow of the inertion gas from the addition points to the vent pipe.

The outer door allows material to be added to the 1st screw feeder. Inerting gas is continuously added to the hopper to displace air from the hopper for eventual routing into the closed-vent system piping that conveys it to the control device.

After materials have been introduced and the container removed, the outer door is closed. The hopper under the loading hood contains four (4) feed screws that convey the loaded material to a fifth screw conveyor that loads into the TMW feed airlock chamber. The airlock chamber is operated in a manner so that there is always at least one closed gate between the first heated screw and the feed screw. Inert gas addition into the lock chamber displaces air which is carried back through the feed screw and out through the feed chamber vent to the control device.

C-2 Heating Screws

After material is loaded and conveyed, the material enters the first heating screw called the thermoscrew. This thermoscrew uses hot oil that is pumped through the screw flighting to raise the feed material to temperatures of up to 650 degrees Fahrenheit while being conveyed at an incline to the next heating screw (electroscrew). The thermoscrew vents to vapors to scrubbing/condensing venturis V-1, V-2 and V-3 through three (3) separate 12-inch pipes.

The second heating screw, called the electroscrew, maintains the temperature of the material with electrical coils mounted to the exterior wall of the screw conveyor trough. This electroscrew uses electrical resistance to raise the feed material to temperatures of up to 1500 degrees Fahrenheit while being conveyed at an incline to the cooling screws. A single vent pipe on the electric heating screw is vented to scrubbing venturi V-4.

TABLE C-1
Detailed Engineering Description
(Continued)

	contact solution	Venturis 1, 2 & 4 (V1, V2 & V4) ~5' tall x 12" dia. gas inlet w/ 16" dia. contact chamber & 8" venturi – top mounted liquid injection nozzle Venturi 3 (V3) ~4'-8"' tall x 10" dia. gas inlet w/ 12" dia. contact chamber & 6" venturi – top mounted liquid injection nozzle Venturi 6 (V6) ~4'-8"' tall x 10" dia. gas inlet w/ 12" dia. contact chamber & 6" venturi – top mounted liquid injection nozzle Performance: 1000 acfm (50% condensable) of gas @ 2" net draft when furnished with 106 gpm of water @ 60 psig to scrubber nozzle
Venturi Scrubber Pumps	Transfer of recovered scrubber residues to heat exchangers & recirculation through system	Venturi recirculation pumps: 3x1.5-13 811M DI/SS by Griswold Pump motors: 15 hp, 1750 rpm, TEFC, 3/230-460/60, M2332T by Baldor Pump rating: 157 gpm @ 150 TDH
Heat Exchangers	Cool recovered liquids from venturi scrubbers	A. Viexbox Heat Exchanger Model VBP-X-SP-23-120-8-29-HV (3 each) Material of construction: carbon steel & 316 stainless steel Provided w/29 internal plates: area calculated/provided (ft2) = 601.5 / 986.5 Heat transfer rate: 172 Btu/hr, ft2, F B. Viexbox Heat Exchanger Model VBP-X-SP-23-60-8-32-HV (2 each) Material of construction: carbon steel & 316 stainless steel Provided w/32 internal plates: area calculated/provided (ft2) = 360.2 / 537.6 Heat transfer rate: 147 Btu/hr, ft2, F C.
Collection Tank T-401	Storage of recovered liquids for transfer or reuse	Custom Fabricated: See part B Appendix D-III.b Tank

TABLE C-1
Detailed Engineering Description

Equipment	Purpose	Description
Waste Loading Hopper & Feed Screws	Hazardous waste feed system	Custom fabricated:
Coil Tube Thermal Heater	Provide recirculated heated oil to Holo-Scru Dryer	Fulton Model: FT-0800C Natural gas-fired oil heater providing ~500 gpm of hot oil at ~650 F Independent stack emission at ~250 F
Holo-Scru Dryer	Vaporization of hazardous waste volatile constituents through indirect heating with heated oil from the heater	Custom fabricated: Materials of construction: Stainless steel & carbon steel ~30' interior trough x ~5'-8" wide x ~4'–10" deep chamber Bottom mounted dual 36" dia. screw conveyors (side by side) with exterior 30 hp drive motor by Baldor: Variable screw speed Process temperature provided through the hot oil transfer input ~ 700 F Design feed rate: 16,000 lb/hr Volumetric capacity: 12 cfm Product inlet temperature: 70 F
Electric-Scru	Vaporization of hazardous waste volatile constituents through indirect heating with electrically derived heat	Custom fabricated: Materials of construction: Stainless steel & carbon steel ~20' interior trough x ~5'-8" wide x 6' deep chamber Bottom mounted dual 36" dia. screw conveyors (side by side) with exterior 30 hp drive motor by Baldor: Variable screw speed Process temperature provided through the electrical heat input ~ 1,500 F (Heat capacity of each screw = 294 Kw Design feed rate: 12,000 lb/hr Volumetric capacity: 8.33 cfm Product inlet temperature: 400 F
Venturi Scrubbers/Separators	Gas scrubbing by entrainment of hazardous waste constituents and cooling in spray liquid	Schutte & Koerting Company Ejector Venturi & Separator: Model 7010 & 7040

Table C-1.1

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TABLE C-1
Detailed Engineering Description
(Continued)

		Assessment for design details
Cooling Screws #1 & #2	Enclosed transfer & cool down of solid residuals recovered from vaporization system	Custom fabricated: Single carbon steel 12'x20" dia screws in a 24" trough equipped with water sprays
Divert	Method of emptying screws when downstream equipment is inoperable	Carbon steel Plate, pneumatically actuated
Chain conveyor and deck	Convey cooled residuals to magnetic separators	Carbon drag chain
Shaker & Magnetic Separators	Removal of scrap metal from residuals	Provided by Industrial Magnets, Inc. Shaker: Derrick Corp.; Model #E-36-96D-2 Large Magnet: Industrial Magnetics, Inc.; Model #SEMO 662SC1A117 Small Magnet: Industrial Magnetics, Inc.; Model #SEMO 422A069
Wet Dust Collector	Provide negative pressure to the Solids separation unit and provide particulate removal prior to exhaust to TOU.	Provided by: Airex Industries WETREX Wet Dust Collector Model #Wetrex-01 Stainless Steel Direct Drive Blower Rated @ 1000 cfm
Demister	Improve Gas Liquid Separation	Carbon Steel 3' diam x 8' cylinder which may accommodate packing and/or liquid spray or may be operated as a simple knockout
Closed Vent Blowers	Provide suction to venturi system and convey remnant non-condensable gas constituents through closed vent system to control device	Gardner Denver TurboPak VFD Regenerative Blower Performance data for air @ standard conditions: Sea level, 14.7 psia, 29.92 Hg, 68 F inlet temperature & 36% relative humidity
Cyclone Separators	Additional liquid knockout	Custom Carbon Steel Cylinders with

TABLE C-1
Detailed Engineering Description
(Continued)

		tangential flow in and axial flow out.
Control Device (TOU-102)	Control closed vent gas by combustion	Custom Fabricated: Material of construction: carbon steel 7'0" inside diameter x 34' total height Pilot: Custom fabricated to provide 45 SCFH of 1000 Btu/scf natural gas @ 10 psig Burner: custom fabricated Combustion air blower: rated @ 500 to 10,000 cfm on demand
Control Device (TOU-103)	Control closed vent gas by combustion	Custom Fabricated: Material of construction: carbon steel 9'0" inside diameter x 40' total height Pilot: Custom fabricated to provide 45 SCFH of 1000 Btu/scf natural gas @ 10 psig Burner: custom fabricated Combustion air blower: rated @ 500 to 10,000 cfm on demand

The atmospheres in both heating screws are inerted with carbon dioxide. Additional vents or shrouds installed around shaft seals collect any gaseous release and pass the vent stream through a condenser before venting to the TOU. In this manner, compliance with the provisions of §264.345(d)(3) for control of fugitive emissions is obtained.

C-3 Cooling Screws

Material discharged from the electroscrew discharge chute is conveyed and cooled in the two inclined cooling screw conveyors. Superheated steam may be injected into the discharge chute to help move vapors into the venturi scrubber (V-4) and prevent condensation of those vapors onto the solids as they cool. The cooling screws use injected water sprays which are atomized with carbon dioxide to cool the hot solid conveyed material. At the discharge of the second cooling screw, the material passes through an airlock chamber to isolate the system from the atmosphere. At the exit of the airlock chamber a divert gate discharges to either a covered tote or onto a chain conveyor.

C-4 Chain Conveyor and Deck Screen

The chain conveyor transfers solid material from the cooling screw divert gate to the vibratory deck screen. The magnetic separators and vibratory deck screen are enclosed and the enclosed atmosphere is swept through a collection pipe to a bag-style dust collector and then into the seal shroud system described above. Solid material entering the vibratory deck screen is separated by size. The smaller size particles are discharged on the "char" magnet conveyor and the larger particles are passed on to the metals recycle magnet conveyor.

C-5 Magnetic Separators

After size separation of the solid materials at the deck screen, the smaller size material passes through a magnetic separator that separates small tramp metal from both char and product streams that are containerized into covered totes. The large solid materials from the deck screen also pass through another magnetic separator. Metals recovered from this larger separator are discharged onto a second chain conveyor into a large container for shipping as scrap metal. The non-metallic discharge is containerized in covered totes.

C-6-i Venturi Scrubbers (V-01, V-02, V-03, V-04, and V-06)

As noted above, hoods on the heating screws are vented to venturis V-01, V-02, V-03 & V-04. The venturis are utilized for condensable gas and particle adsorption for removal from the vent stream by spraying recirculated cooled liquids into the transition of the venturi. The condensed and captured liquid is then removed from the base of the venturi unit and pumped to heat exchangers for cooling. The liquid is then recirculated back to the sprayers at the top of each venturi.

Scrubbed vent gases from venturi V-01, V-02, V-03, & V-04 are collected and scrubbed again in venturi V-06 where recovered liquids are cooled at the heat exchangers and returned to the sprayers. Scrubbed gases are then passed onto the closed vent system to Thermal Oxidizer TOU-102/103 through a series of demister and cyclones.

C-6-ii Venturi Scrubber (V-05)

The first cooling screw is also provided with a vent to venturi V-05 utilized for condensable gas and particle adsorption for removal by spraying recirculated cooled liquids into the transition of the venturi. Vent gases scrubbed in venturi V-05 are then conveyed via the V-01, V-02, V-03, & V-04 collection line to venturi V-6.

C-7 Heat Exchangers

Heat exchangers are used to cool recovered liquid from the venturi separators for return to the sprayers in the venturi. Excess cooled liquids are routed to Tank T-401 or to a tanker for transport. The heat exchangers are piped with hose connections to allow for removal from the system for periodic cleaning and repairs. The exchangers use cooling water from a nearby cooling tower in a closed sealed loop to cool the liquid stream recovered in the venturi.

C-8 Agitated Tank T-401

The collection tank T-401 is used for the collection of condensed hydrocarbons and water from the liquid stream of the TMW system.

This closed top steel tank is a vertical cylinder complete with a top-mounted agitator, AP-401. Liquid materials are diverted to the tank via a manifold. Pipelines leading to the manifold are divert lines off of the cooled liquid recirculation lines to the TMW venturis. CO_2 is added to the tank via actuated valve to displace oxygen in the tank. A vent line on the top of the tank collects displaced vapors, cools them in a separate heat exchanger and returns any condensed liquids to the tank. The CO_2 and other non condensibles are then conveyed to shroud collection system described above.

In addition, pipelines at varying elevation of the tank are provided for stratified recovery of liquids. Periodically, the collected hydrocarbons and other liquids are transferred to a tanker truck or transferred to the Building 200 tank farm.

Collected liquids are removed from the tank by the transfer pump to a tanker truck, Building 200 tank farm, or returned as cooling liquids to the TMW venturis.

C-9 Closed Vent System and Control Device

The scrubbed vent gas from venturi V-6 passes through a demister to remove entrained liquid vapor that was not removed in the venturi separator. The vent gas then passes through a cyclone on the suction-side of the vent blower for an additional separation of entrained liquid. Two (2) blowers are piped in parallel (one acts as a spare) that conveys the captured vent gas through a final cyclone and on to the closed vent system to Thermal Oxidizer TOU-102/103. Removed liquids from the demister and cyclones are collected into a tote container and periodically transferred to one of the various available storage units.

Refer to Attachment 1 herein for the closed-vent system and control device design assessment relevant to the TMW system.

C-10 Process Monitoring & Control

Various monitoring devices are utilized for monitoring of temperature, pressure, and flow in the TMW. These devices are installed in locations indicated in Figures 029A, 029B, 029C and 038 of the part B application. The specific monitoring devices are listed in Table C-2, TMW Control System Parameters. This table further indicates the typical operating envelope of the equipment being monitored. Table F-4 presents the TMW Trial Burn Operating Regimen with Automatic Waste Feed Cutoffs (AWFCOs).

C-11 TMW Layout and Containment

The TMW is located within Building 400 in the central area of the facility. Part B Figure 005 provides the location of Building 400 at the facility. Part B Figure 047 provides a more detailed layout of the primary elements described above along with secondary containment provisions for the system.

D. DETAILED DESCRIPTION OF SAMPLING, ANALYSIS AND MONITORING PROCEDURES

Detailed explanations of EPA sampling methods, descriptions of pretest preparation, calibrations, sample collection, sample recovery, analysis, detailed method performance criteria, data reduction, validation, calculations, and quality control procedures will be presented in the Trial Burn Report for the Thermal Metal Wash Trial Burn.

Sampling will be conducted of the control device exhaust gas and the results used to support the TB objectives. Approved EPA and SW-846 test methods will be employed to collect each exhaust gas sample where such sampling methods exist.

D-1 Exhaust Gas Samples

Sampling ports have been provided such that sampling of the control device exhaust gas can be adequately conducted at a location: 1) whereby combustion gas residence time has been achieved that is at least 2 stack diameters beyond the control device burner [that causes disturbance] and 2) at least ½ diameters preceding the stack exhaust outlet. Platforms surrounding the stack are provided consistent with sample port locations to allow for personnel to operate and manage the necessary sampling trains required. EPA Method 1 (40 CFR §60) will be used to establish the required traverse for sampling points and demonstrate the absence of cyclonic flow conditions.

Table C-2
TMW Control System Parameters

No.	Equipment ID	Monitoring Parameter	Parameter Description	Unit of Measure	Parameter Range			Permissive/ Interlock/Alarm
					High	Typical	Low	
1	WT FEED_HOP_1SEC	W	Load Scale on Loading Hopper	Lbs	NA	4,000	0	Monitor Only
2	T OIL_HEAT	T	Thermo Screw Oil Supply Temperature	Deg. F	650	590	Amb	Monitor Only (Temp Controlled by Oil Heater)
3	T V-1_GAS	T	Thermo Screw Vapor Exhaust Gas Temperature into V-1	Deg. F	1,100	200	Amb	Monitor Only
4	P V-1_LQ_NZL	P	V-1 Cooled Liquid Supply Pressure for Spray Nozzle	psi	10	4 - 5	0	Monitor Only
5	T V-1_LIQ	T	V-1 Cooled Liquid Supply Temperature	Deg. F	160	110 - 130	90	Monitor Only
6	P V-1_LQ_PMP	P	V-1 Condensate Transfer Pump Pressure	psi	100	20 - 35	0	Alarm Only on High Pressure
7	T V-2_GAS	T	Thermo Screw Vapor Exhaust Gas Temperature into V-2	Deg. F	1,100	200	Amb	Monitor Only
8	P V-2_LQ_NZL	P	V-2 Cooled Liquid Supply Pressure	psi	10	2 - 3	0	Monitor Only
9	T V-2_LIQ	T	V-2 Cooled Liquid Supply Temperature	Deg. F	160	110 - 130	90	Monitor Only
10	P V-2_LQ_PMP	P	V-2 Condensate Transfer Pump Pressure	psi	100	20 - 35	0	Alarm Only on High Pressure
11	T V-3_GAS	T	Thermo Screw Vapor Exhaust Gas Temperature into V-3	Deg. F	1,100	300 - 700	Amb	Monitor Only
12	P V-3_LQ_NZL	P	V-3 Cooled Liquid Supply Pressure	psi	10	4 - 8	0	Monitor Only
13	T V-3_LIQ	T	V-3 Cooled Liquid Supply Temperature	Deg. F	190	120 - 180	110	Monitor Only
14	P V-3_LQ_PMP	P	V-3 Condensate Transfer Pump	psi	60	30 - 40	0	Alarm Only on High Pressure
15	T V-4_GAS	T	Thermo Screw Vapor Exhaust Gas Temperature into V-4	Deg. F	1,400	600 - 1,200	Amb	Alarm Only on High Temperature
16	P V-4_LQ_NZL	P	V-4 Cooled Liquid Supply Pressure	psi	12	6 - 10	0	Monitor Only

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Table C-2
TMW Control System Parameters

No.	Equipment ID	Monitoring Parameter	Parameter Description	Unit of Measure	Parameter Range			Permissive/ Interlock/Alarm
					High	Typical	Low	
17	T V-4_LIQ	T	V-4 Cooled Liquid Supply Temperature	Deg. F	170	130 - 160	110	Monitor Only
18	P V-4_LQ_PMP	P	V-4 Condensate Transfer Pump Pressure	psi	60	30 - 50	0	Alarm Only on High Pressure
19	P SCREW_N a or b	P	Cooling Screw #1 or #2 N Internal Pressure	in W.C.	10	0	-10	Monitor Only
20	P SCREW_S a or b	P	Cooling Screw #1 or #2 S Internal Pressure	in W.C.	10	0	-10	Monitor Only
21	T COOL-2_EX	T	Cooling Screw #2 Solids Discharge Temperature	Deg. F	NA	NA	NA	NOT CURRENTLY OPERATING
22	T V-5_GAS	T	Cooling Screw #1 Vapor Exhaust Gas Temperature into V-5	Deg. F	1,200	300 - 1,000	Amb	Monitor Only
23	P V-5_LQ_NZL	P	V-5 Cooled Liquid Supply Pressure	psi	10	4 - 6	0	Monitor Only
24	P V-5_LQ_PMP	P	V-5 Condensate Transfer Pump Pressure	psi	100	30 - 45	0	Alarm Only on High Pressure
25	T SHAKER	T	Shaker Screen Interior Temperature	Deg. F	200	150	Amb	Alarm Only on High Temperature
26	T SM_MAG	T	Small Magnet Interior Temperature	Deg. F	200	110 - 200	Amb	Monitor Only
27	T LG_MAG	T	Overs Magnet Interior Temperature	Deg. F	200	110 - 200	Amb	Monitor Only
28	T LGMG_H2O_OUT	T	Overs Magnet Cooling Water Return Temperature	Deg. F	105	95	45	Monitor Only
29	T LGMG_H2O_IN	T	Overs Magnet Cooling Water Supply Temperature	Deg. F	86	80	45	Monitor Only
30	P BAG_H_DP	P	Wet Dust Collector Pressure Differential	in W.C.	50	5	0	Monitor Only
31	P 6IN_BLOW	P	Pressure in 6 in Blower Line from V-5	in W.C.	250	15	0	Monitor Only
32	P 12IN_LINE	P	V-6 Inlet Pressure	in W.C.	15	-5	-12	Monitor Only

Table C-2
TMW Control System Parameters

No.	Equipment ID	Monitoring Parameter	Parameter Description	Unit of Measure	Parameter Range High	Parameter Range Typical	Parameter Range Low	Permissive/ Interlock/Alarm
33	P 3IN_LINE	P	Closed-vent Blower (3") Inlet Pressure	in W.C.	2	-8	-15	Monitor Only
34	T 3IN_LINE	T	Closed-vent Blower (3") Inlet Temperature	Deg. F	160	110	Amb	Monitor Only
35	P V-6_LQ_PMP	P	V-6 Condensate Transfer Pump Pressure	psi	100	20 - 35	0	Alarm Only on High Pressure
36	P 3IN_BLOW	P	Closed-vent Blower (3") Outlet Pressure	in W.C.	250	50 - 75	0	Monitor Only
37	F 3IN_LINE	F	Closed-vent Line (3") Flow to TOU	DP - in W.C.	250	20 - 30	0	Monitor Only Chart Compared for Flows
38	TORQ HEAT SCRW1	TQ	Torque on Heating Screw #1 Drive	in-lbs	10,000	2,000 - 5,000	0	Interlock Feed Hood/ Cascade with HS2 Torque
39	TORQ HEAT SCRW2	TQ	Torque on Heating Screw #2 Drive	in-lbs	10,000	2,000 - 5,000	0	Interlock Heat Screw #1 Cascade with CS1 Torque
40	TORQ COOL SCRW1	TQ	Torque on Cooling Screw #1 Drive	in-lbs	10,000	2,000 - 5,000	0	Interlock Heat Screw #2 Cascade with CS2 Torque
41	TORQ COOL SCRW2	TQ	Torque on Cooling Screw #2 Drive	in-lbs	10,000	2,000 - 5,000	0	Interlock Cooling Screw #1
42	O2 V-6 3IN_LINE	O2	Oxygen Sensor on Vent Line from V-6 to TOU	%	33	12	0	Alarms & Interlocks Feed Hood On High Only
43	T TOU-102 STACK	T	Temperature at TOU Stack	Deg. F	2,000	1,600	1,500	Alarms & Interlocks Feed Hood On Low Alarms On High Only
44	T TOU-103 STACK	T	Temperature at TOU Stack	Deg. F	2,000	1,600	1,500	Alarms & Interlocks Feed Hood On Low Alarms On High Only
45	LV V-1_LQ_SEP	LV	Liquid Level V-1 Separator	in	18	12	0	Interlocked with Valve XV-V1-DISCH
46	LV V-2_LQ_SEP	LV	Liquid Level V-2 Separator	in	18	12	0	Interlocked with Valve XV-V2-DISCH
47	LV V-3_LQ_SEP	LV	Liquid Level V-3 Separator	in	18	12	0	Interlocked with Valve XV-V3-DISCH
48	LV V-4_LQ_SEP	LV	Liquid Level V-4 Separator	in	18	12	0	Interlocked with Valve XV-V4-DISCH

Table C-2
TMW Control System Parameters

No.	Equipment ID	Monitoring Parameter	Parameter Description	Unit of Measure	Parameter Range			Permissive/ Interlock/Alarm
					High	Typical	Low	
49	LV V-5_LQ_SEP	LV	Liquid Level V-5 Separator	in	18	12	0	Interlocked with Valve XV-V5-DISCH
50	LV V-6_LQ_SEP	LV	Liquid Level V-6 Separator	in	18	12	0	Interlocked with Valve XV-V6-DISCH
51	TM V-1_FILTER	TM	Timer V-1 Filter Backwash	S	3,600	1,200	0	Interlocked to close Filter Isolation Valve XV_V1_DISCH and open XV_V1_BACKWASH
52	TM V-2_FILTER	TM	Timer V-2 Filter Backwash	S	3,600	1,200	0	Interlocked to close Filter Isolation Valve XV_V2_DISCH and open XV_V2_BACKWASH
53	TM V-3_FILTER	TM	Timer V-3 Filter Backwash	S	3,600	1,200	0	Interlocked to close Filter Isolation Valve XV_V3_DISCH and open XV_V3_BACKWASH
54	TM V-4_FILTER	TM	Timer V-4 Filter Backwash	S	3,600	1,200	0	Interlocked to close Filter Isolation Valve XV_V4_DISCH and open XV_V4_BACKWASH
55	LV-T-401-S1	LV	Liquid Level Tank T-401	in	24	12	0	Interlocked with Inlet Valves from V1, V2, V3 & V4 Valves (XV-V1-DISCH, etc.)
56	LV-T-401-S2	LV	Liquid Level Tank T-401	in	24	12	0	Interlocked with Inlet Valves from V1, V2, V3 & V4 Valves (XV-V1-DISCH, etc.)
57	P 24IN_LINE	p	Pressure in Fugitives Control Vent	in W.C.	0	0	-4	Alarms & Interlocks Feed Hopper on High
58	CO TOU-102 STACK	C	Carbon Monoxide Concentration at TOU Stack	ppm	100	90	0	Alarms & Interlocks Feed Hopper on High
59	HC TOU-102 STACK	C	Hydrocarbon Concentration at TOU Stack	ppm	10	8	0	Alarms & Interlocks Feed Hopper on High
60	CO TOU-103 STACK	C	Carbon Monoxide Concentration at TOU Stack	ppm	100	90	0	Alarms & Interlocks Feed Hopper on High
61	HC TOU-103 STACK	C	Hydrocarbon Concentration at TOU Stack	ppm	10	8	0	Alarms & Interlocks Feed Hopper on High

Sampling and analysis of the exhaust gas will be performed to determine emissions of particulate matter, hydrogen chloride, chorine, metals, dioxins/furans, and volatile and semivolatile products of incomplete combustion (PICs) in order to document compliance with applicable regulatory requirements and to prepare a multi-pathway site-specific assessment. The methods indicated in Table D-1 will be utilized for exhaust gas sampling and recovery.

TABLE D-1

Rineco Stack Testing Program

Test Methodologies	Sample Trains Required	Parameter
EPA Methods 1 & 2	Sampling per Method	Velocity Profile And Volumetric Flow Rate
Method 3A	Selected Sample Train	O_2 & CO_2 Concentrations
EPA Method 4	Each Sample Train	Flow & Moisture
EPA Method 10	Selected Sample Train	Carbon Monoxide
Method[1] 0010	Combined Sample Train / Split Sample Recovery[2]	Semi-Volatile Organics
Method[1] 0023A		Dioxins/Furans
EPA Method 25A	Selected Sample Train	Total Hydrocarbon
EPA Method 5 & 26A	Combined Sample Train / Split Sample Recovery	Particulate, HCl, Cl_2
EPA Method 29	Sample Train	Multiple Metals
Method[1] 0030	Sample Train	Volatile Organics

[1] SW-846 Methodology
[2] See Figure D-1 that follows for the proposed Method 23 / Method 0010SV Sample Train split (3-way split)

Laboratory analysis will be conducted in accordance with approved SW-846 and U.S. EPA Method procedures for the required parameters.

D-2 Feed Samples

Rineco proposes a custom feed mixture designed to be measureable as well as a balance between overall metals and bulk content. The design is further intended to document the ability of the system to control pollutants of concern.

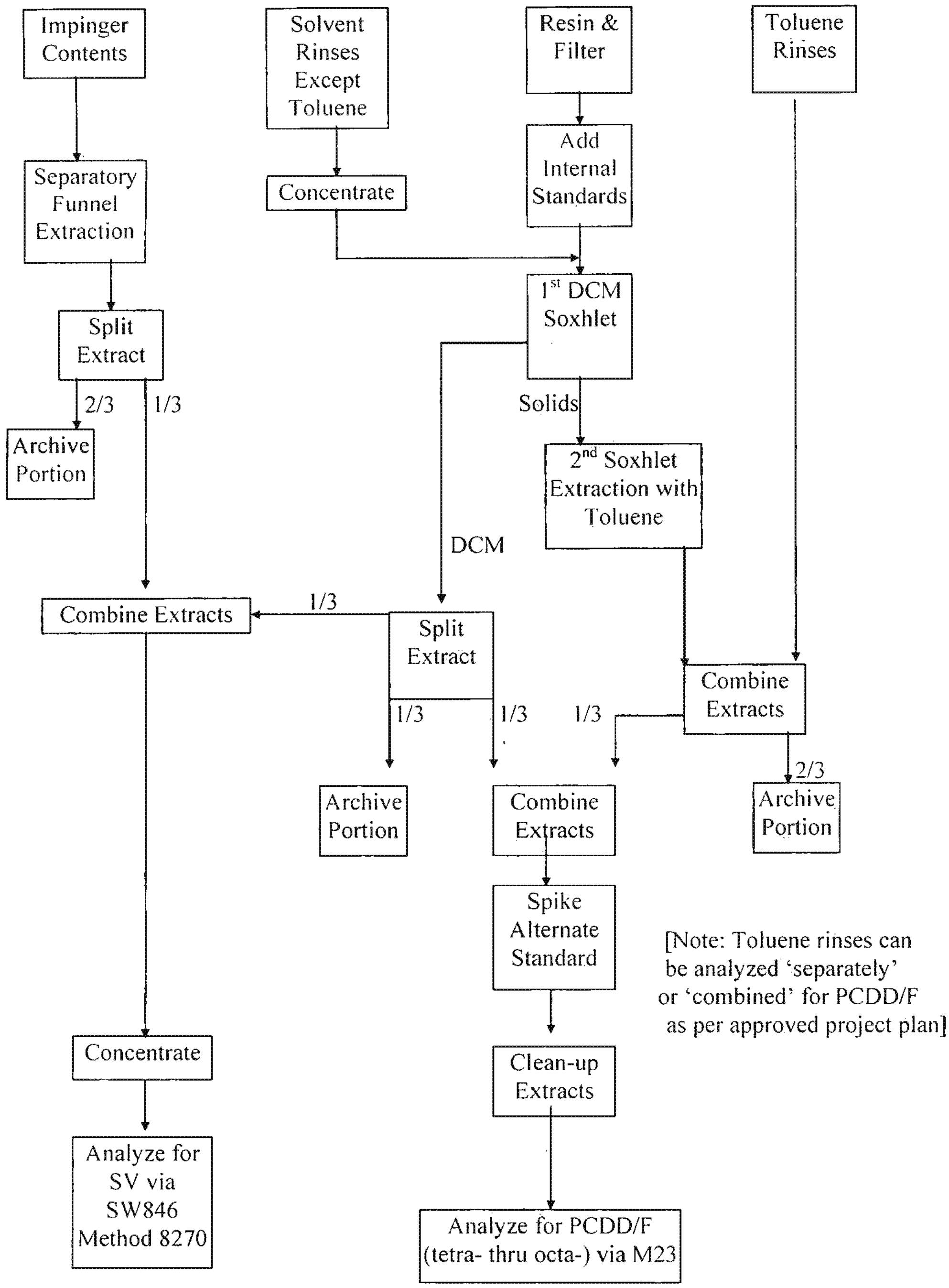
Constituents in the feed specifically prepared for the TB will be weighed to characterize the feed mixture constituents proposed for trial burn implementation. See Section F that follows for detailed feed mixture design. The feed mixture will be comprised of a combination of scrap metal materials and sand for bulk. This inert mixture will be combined with specific spiked compounds of known quantity (spikes as shown in Section F Tables) selected for testing as required for the TB objectives.

As required under APC&EC Regulation 270.62(b)(2)(i)(c), the part A waste code listing has been prepared to identify the various waste code types potentially processed in the TMW (refer to the part A waste code list process code X03 specific to the TMW). The waste codes listed therein correspond with the Appendix VIII hazardous organic constituents presented in §261, Appendix VIII.

FIGURE D-1

TMW TRIAL BURN PLAN

Combined M23/0010SV Train (3-Way Split)



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D-3 Waste Residual Samples

Waste residuals, including solids and liquids, generated during the trial burn will be collected for sampling and analysis. The predominance of liquids will be collected from the liquid stream of the TMW system. Other liquid streams that could potentially be captured in totes will be transferred and composited into either Tank T-401 or a tanker container for a single composite sample with analysis of parameters listed in Table D-2.

Solid residuals generated from the system will be collected at the divert tote(s). Each tote will be itemized, weighed and sampled. The resulting samples will be composited into a single sample for analysis of parameters. Table D-2 lists the process samples to be collected during the trial burn.

E. TEST IMPLEMENTATION

Upon implementation, a minimum of three test runs for the various sampling methods is planned for the TMW TB. In addition, preparation time, system startup and stabilization, other preparatory activities, and sample recovery activities may restrict performance to one test run per day.

Prior to each test run Rineco management will assemble an informal meeting among necessary TMW operating and contract personnel to ensure resolution of any last minute issues and concerns. The TMW will be brought to operational test status and feed will be initiated. The TMW will be considered at steady-state once the desired feed rate and operating conditions, as applicable, defined in this test plan have been attained. Process monitoring will be on-line at all times during the TMW TB. When the Rineco Test Director determines that steady-state operating conditions have been achieved he will notify all appropriate personnel and exhaust gas sampling will begin.

After the post-run data has been collected, the TMW Test Director will determine the success of the test run based on the available data. The TMW test director will confirm with the ADEQ as necessary that the test run was successful, as applicable, and evaluate the need to perform additional test runs as appropriate. A daily informal post-test meeting may be held to review events and plan the next day's activities.

E-1 Schedule

The TB will be scheduled upon approval of the TB plan. Rineco is anticipating actual stack sampling efforts to be conducted over a two (2) day period. The time period for conducting the various runs required will vary depending on the sampling methods being employed. The following schedule details the anticipated (i.e., subject to change) activities during trial burn testing periods:

- o The stack sampling contractor will mobilize equipment to the sampling location for the TB (anticipated one day duration). Preliminary velocity checks will be conducted for the TB test condition, cyclonic flow check, and blank trains

TABLE D-2
TMW TRIAL BURN PROCESS SAMPLING FREQUENCY AND LOCATIONS

Sample Type	Analytical Parameters	Sampling Method	Analytical Methods	Sample Location	Sample Frequency
Organic Liquid Spike (Constituent) Feed Mix	Semivolatile & volatile organic compounds, PCDD / PCDF, total chlorine, metals	Method S001 (Coliwasa)[1]	SW846 Method 8260B, 8270C & 8290 as appropriate	Mix Container	1 composite sample per container per constituent
Metal Spike Constituents	Metals	Method S001 (Coliwasa)[1]	SW-846 Methods 6010B, 6020, 7470A / 7471A	Mix Container	1 composite sample per container per constituent
Residual Liquid	Total chlorine, metals, total dissolved solids, total suspended solids, pH, specific gravity	Method S001 (Coliwasa)[1]	SW-846 Methods 6010B, 6020, 7470A / 7471A	TMW Tanker Truck	1 composite sample per container per run
Residual Solids / Existing Scrap Metal	Semivolatile & volatile organic compounds, PCDD / PCDF, total chlorine, metals	Method S006 (Trier or Sample Corer)[1]	SW-846 Methods 6010B, 6020, 7470A / 7471A	Divert Chute Tote	1 composite sample per container per run
Incoming Water (Process)	Total chlorine, metals	Method S004 (Tap Sampling)[1]	SW-846 Methods 6010B, 6020, 7470A / 7471A	Tap in fresh water process line	1 sample per trial burn
Caustic	Total chlorine, metals	Method S004 (Tap Sampling)[1]	SW-846 Methods 6010B, 6020, 7470A / 7471A	Tap in caustic container	1 sample per container

Notes: [1] Sampling methods desribed in "Sampling and Analysis Methods for Hazardous Waste Combustoion," EPA-600/8-84-002, 1984

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(anticipated one day duration).

- Complete 1st day of selected TMW TB Methods Runs 1-3 (anticipated one day duration).

- Complete 2nd day of selected TMW TB Methods Runs 1-3 (anticipated one day duration).

- The field sampling contractor will pack and ship TMW TB samples to the selected analytical laboratories (anticipated one day duration).

Upon completion of the TB, necessary test reports and associated data will be submitted to ADEQ and EPA Region VI within all prescribed timelines.

E-2 Duration

TB duration will depend on the number of test runs required and the response of the TMW equipment during the actual testing conditions. The TB will consist of at least three successful test runs for each sampling method during which the stated sample data will be obtained. Each time period for conducting the test runs will vary depending on the sampling method(s) being implemented, however Rineco is projecting these activities to involve up to twelve (12) hours of operational testing per day. This does not include the time necessary for the TMW to reach steady-state conditions, or to conduct sample method train leak tests and port relocations, or new trains for subsequent runs. Each TB run will involve all necessary activities as specified for the stated sampling methods being conducted.

Sufficient time will be provided such that additional samples may be collected to reserve for the rejection of samples because of excessive leak rates, broken samples during recovery efforts, or unacceptable isokinetic conditions. Additional test runs will be conducted as required to account for such sampling problems as well as operational difficulties.

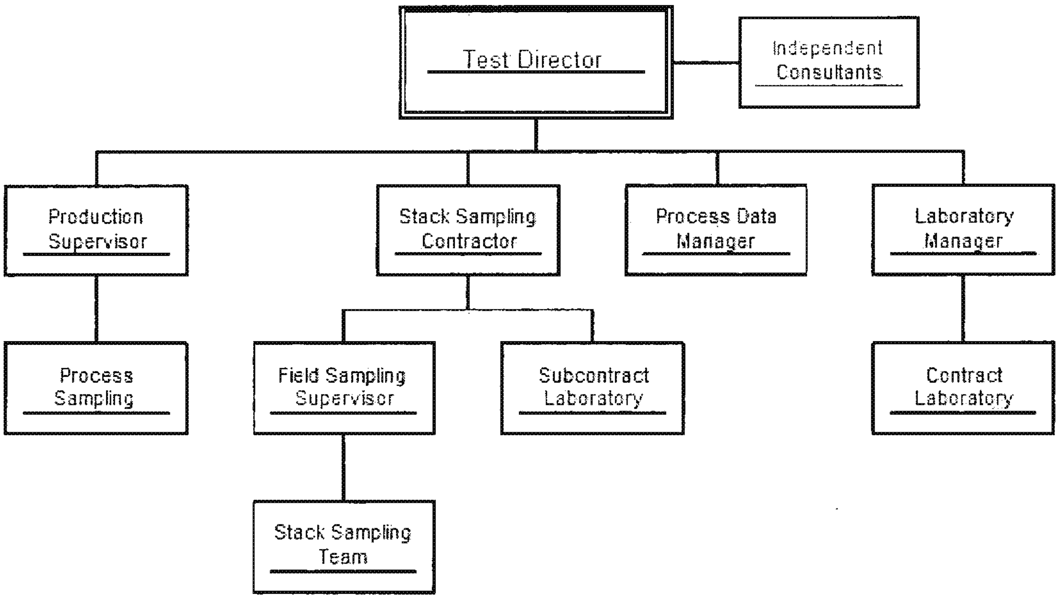
E-3 Organization of Activities

Rineco will utilize the services of an independent sampling contractor to provide for all stack gas sampling, recovery and analysis services to include the necessary transport of recovered samples to an independent laboratory for subsequent analysis. The sampling contractor will provide for all necessary quality assurance and quality control (QA/QC) activities associated with these tasks, for data validation of stack gas sampling results and reporting of the results.

Rineco personnel will maintain task responsibility for all other activities including gathering of process samples, operation of data monitoring equipment, operating records generation and accumulation of system operating data. An independent laboratory will be utilized for analysis of process samples and validation of the results. Data gathered by Rineco and the sampling contractor will be consolidated for inclusion in the Trial Burn Report and utilized in preparation of the multi-pathway site specific assessment report.

Figure E-1 provides for a conceptual organization chart of these activities. Additional conceptual descriptions of individual responsibilities follow.

Figure 1-1
TMW Trial Burn Organization Chart



Conceptual project organization descriptions:

Test Director:

Responsible for all activities involved with preparation, implementation, and reporting as required for completion of the TMW trial burn and submittal of the final report to the necessary regulatory agencies.

Production Manager:

Responsible for overall operation of the TMW and control device and for providing personnel as necessary to obtain the necessary process samples described in the TB Plan.

Stack Sampling Contractor:

Responsible for providing all necessary personnel and equipment to supervise and conduct the required stack gas sampling and recovery, development of stack sampling field records, labeling and chain-of-custody documents, and shipment to the subcontract laboratory; Responsibilities further include employment of the subcontract laboratory and all services provided thereof, and for reporting of all field sampling activities and data analysis results to the Test Director.

Subcontract Laboratory:

The subcontract laboratory is directly employed by the Stack Sampling Contractor. Responsible for receipt and management of all stack samples received, for analysis, data and records validation, and reporting of analysis results to the Stack Sampling Contractor.

Field Sampling Supervisor:

Responsible for all stack sampling field activities, including sampling team members and equipment, recovery of samples, development of stack sampling field records, labeling and chain-of-custody documents, and shipment to the subcontract laboratory.

Process Data Manager:

Responsible for TMW process monitoring and data logs, data generation, and associated reporting.

Laboratory Manager:

Responsibilities include receipt of all process samples from the production supervisor, labeling and chain-of-custody documents, and shipment to the contract laboratory; Also responsible for overall project data validation and integrity.

Contract Laboratory:

The contract laboratory is directly employed by Rineco. Responsible for receipt and management of all process samples received, for analysis, data and records validation, and reporting of analysis results to the Rineco Laboratory Manager.

Independent Consultants

Independent consultants will be employed as necessary for assistance with any activities determined necessary by Rineco.

F. TEST PROTOCOLS

EPA's Combustion Strategy calls for a multi-pathway, site specific risk assessment based on emissions measured at both low temperature and high temperature conditions while feeding wastes normally treated at a hazardous waste combustion facility. In contrast however, the design and operation of the TMW is not consistent with these test protocols as envisioned for incinerator trial burns. For instance, operation of the TMW at lower temperatures would serve to minimize vaporization in the unit as well as emissions control requirements. Downstream, the control device was designed according to applicable regulation to operate at a minimum temperature of 1500°F (air permit) in order to reduce total organic emissions delivered to it by 95%. Thus the lone test condition proposed for the TB is based on the TMW being operated by inducing indirect temperatures up to 1500°F (at the 2nd stage), followed by cooling down of collected vapor streams to 130°F (in accordance with the facility air permit) prior to venting the remaining closed-vent stream gases to the control device (vapor incinerator) operated at minimum temperature (1500°F).

In addition, Rineco utilizes one of two control devices, or thermal oxidation units (TOU-102 or TOU-103), for the control of organic emissions from the TMW at a given time. As planned, Rineco intends to conduct testing utilizing only the smaller unit, TOU-102, as the selected control device during trial/risk burn testing of the TMW.

The smaller unit, TOU-102, is a seven (7) foot diameter unit with forced combustion air introduction and natural convection for quench air. TOU-103 is a nine (9) foot diameter unit with an axisymmetric burner to TOU-102. TOU-103 has 65% more flow area in the stack and, therefore, 65% more residence time at the same height than TOU-102. TOU-103 has forced combustion air and forced quench air which yields more turbulence and, therefore, more mixing for quenching and combustion than TOU-102. Further, the physical length to diameter (L/D) ratios of the two units is 4.44 vs. 4.52; within 2% of each other, and both units have separate 5 MMBtu natural gas assisted burners which are of symmetric Rineco design. Based on the above rationale and basic design comparisons, since TOU-103 has more capability than TOU-102, upon documentation of meeting the test objectives with TOU-102, TOU-103 need not be tested separately.

Test protocols for the TMW and control device are provided based on the above rationale. The protocols will ensure collection of the information as directed by ADEQ to complete a multi-pathway, site specific risk assessment as requested by EPA as well as to determine compliance with any other applicable emission standards and tests.

Testing will be conducted utilizing a feed mixture as described below in Tables F-1, F-2 and F-3. Known quantities of selected spike constituent(s) will serve as typical feed constituents for stack gas sampling.

Rineco will also attempt[2] to quantify the maximum metals emission limitations during testing. Metal emissions limitations will be determined by relating emissions resulting due to spiking in the TMW with various metals of concern. Data will be collected during the TB to demonstrate compliance with applicable emission limits and performance standards, to establish any necessary operating conditions for metals control, and to conduct the multi-end-point risk assessment.

In general, parameters will be measured as directed by ADEQ for documentation of the multi-end-point risk assessment, including volatile and semivolatile organics, particulate matter[3], metals, dioxin & furans and HCl and chlorine. All spike components will be fed in predetermined quantities as described below.

F-1 TMW TB Program

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[2] Due to the operating regime of the TMW, Rineco does not suspect that metals emissions are an air emissions concern. Thus maximum allowable metals emissions rates may not be reached during testing.
[3] Due to elevated temperatures (±1500°F) at the stack specific particle size sampling is not proposed as being feasible, however the effort will be made to make these determinations with available data samples.

The TMW TB will be conducted to demonstrate the objectives defined in Section B.1 above. The TB will also demonstrate compliance with performance standards and-emission limitations as applicable, verify that the operation of the TMW and associated control device does not pose an unacceptable risk to public health and the environment, and serve to establish operating parameter limits that may be determined necessary.

Prior to initiation of the trial burn protocols defined herein the TMW will be drained of all solid and liquid residuals from on-going operations. The system will not be decontaminated prior to testing.

The TMW TB will be based on one test condition consisting of at least three valid test runs for the various sampling methods employed to demonstrate particulate matter and metals control effectiveness, operating parameter limits, and to provide data to support a multi-pathway, site specific assessment of potential impacts to human health and the environment at maximum feed rates to the TMW.

F-2 Typical Waste Feed

F-2-i Test Burn Feed

The TMW is utilized for processing various hazardous waste streams inclusive of the listed and characteristic wastes identified in the part A waste code list (identified by treatment code X03) based on selected factors. Some of these factors include waste compatibility, recoverable scrap metal content, volatile and semivolatile material content (both halogenated and nonhalogenated) and the overall impact of certain feed material on component maintenance (high or low pH).

Examples of waste generator types include: hydrocarbon and chemical processing industries, petroleum refining, paint application and removal, cosmetics manufacturing, ink production, off specification commercial chemical products, printing, cleaning solvents and surface coatings. The types of wastes to be processed are all common wastes including solids, liquids and sludges that are either containerized or non-containerized. Examples include ignitable (paint, etc.), corrosive (drain cleaners, etc.), and toxic (degreasers, etc.) wastes, off-specification and out-dated commercial chemical products; and other flammable and combustible wastes such as aerosols and propellants.

Compatible wastes may be compiled into totes for direct feed without prior processing (shredding or blending) or shredded and then compiled in totes for feed.

A typical residual yield of processed waste follows:

TABLE F-1
Typical Waste Residual Composition

Residual Composition	Quantity (weight %)
Scrap Metal	25 - 35
Liquid	30 - 40
Char	25 - 35
Other Miscellaneous Debris	5 - 12
Total	100%

The TMW is not utilized for processing reactive wastes.

F-2-ii Rationale for Selection of Spike & Surrogate Feeds

Composition of waste feed streams varies. It is not possible to know the base composition of any typical feed, since the feeds come from various sources.

The maximum expected metal concentrations will be tested for removal efficiencies and their fate will also be determined. In order to facilitate injection in a water solution, the metals will be introduced in a salt form into a metered solution. That solution will be injected in order to achieve an effective concentration in the feed. The effective concentrations of the metals in the feed (not including any associated anion or coordination atoms such as oxygen) are listed in Table F-3 below.

F-3 Feed Rate, Composition and Quantities to be Processed

Statistically conforming feed mixtures targeting 16,000 pounds per hour during all testing will be fed to the TMW during the TB. Tables F-1, F-2 and F-3 outline the target anticipated feed characteristics and metals content in the feed, dependent on the specific test method, identified for a conforming feed characterization proposed for the TB.

Feed will be prepared prior to the TB test runs, accumulated in tote containers of approximate 300 gallon capacity and the weight recorded. Upon initiation of the TB event the contents will then be fed to the TMW feed hopper. The feed hopper components have been specifically designed to manage the capacity of the tote containers being utilized. A typical tote container utilized for feed transfers manages waste with an approximate tare weight between 1,000 and 1,500 pounds. Therefore, approximately 2,000 pounds of waste can be fed to the TMW feed hopper for each batch load (tote container).

In addition, the following list displays the feed materials and associated weight ranges that are expected to be processed during TB operations:

TABLE F-2
Expected Trial Burn Feed Composition

General Feed Type	Quantity (weight %)
Scrap Metal	25 – 35
Water	0 - 8
Sand	55 - 75
Spike Constituents	As Required
Total	100%

The total weight of the contents of each tote fed to the TMW is tracked at all times. Rineco will provide for the proposed spike injections into the system as described under F-5 Feed Methodology below.

Upon the completion of each test run the resulting solid residuals generated will be accumulated and samples obtained for analysis of the specific constituents involved in the test run. The result will provide for determination of fate during the subject test run as well as background concentrations for the subsequent run, whereby the feed composition may be re-used for the subsequent test run[4]. Therefore, based on 4 hours of test condition operations per run (3 hour runs are anticipated) the proposed feed quantities to support the TB runs are as follows based on the targeted aggregate feed rate per hour:

<u>Total Feed Required</u>
= 16,000 lbs/hr × 4 hr sampling/run ÷ 1 ton/2,000 lbs = <u>32 tons / run</u>

F-4 Feed Constituents

The feed for the TB will consist of reasonably known quantities of spike material(s) as described herein and bulk materials to comprise the balance of the total permitted feed rates.

[4] New surrogate or spike constituents will be provided for each test run.

TABLE F-3Anticipated Maximum Metal Content of Feed

Metal	Approx. Feed Concentration (parts per million)
Antimony	10
Arsenic	10
Barium	10,000
Beryllium	10
Cadmium	100
Chromium	1,000
Copper	10,000
Lead	1,000
Manganese	100
Mercury	5
Nickel	5,000
Selenium	10
Silver	100
Thallium	10
Vanadium	3
Zinc	10,000

F-5 Feed Methodology

During operations in the TMW, the selected material from tote containers will be loaded into the TMW feed hopper where it will be transferred into the primary (hot oil) heated screw conveyor. Load and processing rates will be recorded and reported in the TB Report. The selected spike compounds as defined will be blended in water and injected at known quantities and rates separately into the primary heated screw conveyor.

The particular compounds being injected during the various test runs will be determined based on the type of test method being deployed (e.g., metal spikes injected for metal emissions stack testing). The selected mixtures will be prepared for each test. Samples of each containerized mixture will be taken for analysis and the rate of addition will be measured during the test.

F-6 TMW Operating Strategy

Table F-4 presents the operating regimen proposed during conductance of trial burn testing for the proposed test program described above:

Table F-4
TMW Trial Burn Operating Regimen

Process Parameter	Unit of Measure	Operating Range		Monitoring Equipment ID	Automatic Waste Feed Cutoff
		Min	Max		
Fugitives Control Vent Pressure					
Pressure	in w.c.	NA	<0	P 24IN_LINE	Y
Thermoscrew					
Oil Temperature	Deg°F	10	NA	T OIL_Heat	Y
Gas Exit Temperature	Deg°F	10	NA	T V-1_GAS	Y
Gas Exit Temperature	Deg°F	10	NA	T V-2_GAS	Y
Gas Exit Temperature	Deg°F	10	NA	T V-3_GAS	Y
Electric Heating Unit					
Gas Exit Temperature	Deg°F	10	NA	T V-4_GAS	Y
Condensers (V6)					
V6 Exhaust Temperature	Deg°F	10	130	T-3 in-Line	Y
Wet Dust Collector					
Pressure drop	in w.c.	Δ 0.5	NA	DP-BAG_H	Y
TOU-102					
Combustion Temperature	Deg°F	1,500	2000	T TOU-102_STACK	Y
CO Exhaust Gas	ppm	NA	100	CO TOU-102_STACK	Y
HC Exhaust Gas	ppm	NA	10	HC TOU-102_STACK	Y
TOU-103					
Combustion Temperature	Deg°F	1,500	2000	T TOU-103_STACK	Y
CO Exhaust Gas	ppm	NA	100	CO TOU-103_STACK	Y
HC Exhaust Gas	ppm	NA	10	HC TOU-103_STACK	Y

* Determined by calculation; N = No, Y = Yes

Operating pressures in the overall TMW system are such that vapors flow to the condenser(s) in operation at a given time. This includes counter-flow at the various TMW heating units into any of the operating venturi condensers. Since all collected vapors are eventually managed in venturi V-6 (second stage), V-6 will be operated at all times during testing. In addition, a single first stage venturi will also be operated during testing as a worst-case operating scenario. The relationship of first and second stage venturis are depicted in the TMW P&IDs.

A comparison of the various first stage venturi units utilized in the TMW yields that venturi V-3 is a ten (10) inch diameter unit, while venturis V-2, V-3, V-4 and V-5 are twelve (12) inch diameter units. Since V-3 has the lowest capacity of any of the first stage venturis, any other venturi will achieve as good or better results, with a higher scrubbing efficiency. Therefore Rineco intends to utilize only V-3 as the lone first stage venturi during testing in order to document compliance with meeting the test objectives for any other venturi unit thereafter.

F-7 Procedures for Waste Feed Shutoff & Emissions Control During Malfunction

If the TOU malfunctions so as to not maintain a temperature of at least 1500°F, or if the vapor line to the TOU exceeds 130°F., the feed system is interlocked and the feed system will automatically stop. An alarm will appear at the control station. The control station operator will contact the operator of the spiking system by radio and the spiking of the feed will be manually stopped. Any other malfunction will give an alarm to the control station operator and he will stop feed and radio to the operator of the spiking system to stop the spiking of the feed.

Once feed has stopped, the Production Supervisor will evaluate the nature of the malfunction and determine if heat to the system needs to be shut off to control any emissions. If no heat and no feed are supplied to the system, emissions will cease.

F-8 Test Upset Criteria

This section establishes certain criteria for determining the validity of a test run if process or sampling interruptions occur. The following criteria, unless waived by any regulatory agency observer(s), will be used to determine the validity of a test run in the event of an interruption:

- If a shutdown of the TMW or the control device lasts longer than two hours, then any regulatory agency observer(s) present will be consulted to determine if the test run should be terminated.

- Sampling during the test runs will continue through any automatic waste feed cutoffs (AWFCOs) to the top of the next minute following the stoppage of feed. The sampling points will be marked, the probes will be removed from the duct, and caps will be placed over the ends of the probes. Sampling will be restarted after applicable TMW TB operating conditions have been reestablished (which will always be at least 15 minutes following the AWFCO event).

- Volatile organic sampling train (VOST) tubes will be retained and sampling will continue following a process interruption if the VOST ran less than 20 minutes prior to the interruption, and the testing started again less than two hours after the process disruption. A new set of unused VOST tubes will replace the exposed sets of tubes if the 20 minute and/or two hour time frames are exceeded.

- If a process interruption occurs and a particular pair of VOST tubes has been used for sampling over an interval of greater than 20 minutes, then that set of tubes will be removed from the sampling train and submitted for analysis. A new set of tubes will be added to the VOST for sampling once the TMW has resumed operating at conditions within the proposed TMW TB parameters. Sampling activities will not resume until operations within these test parameters are reestablished.

Appendix D-VII
Attachment 1

Thermal Metal Wash
(TMW) System

Closed Vent System & Control Device Design Assessment:
Thermal Oxidation Units (TOU 102 & 103)

Revised 10-14-10

THERMAL METAL WASH
CLOSED VENT SYSTEM & CONTROL DEVICE
DESIGN ASSESSMENT
THERMAL OXIDATION UNITS (TOU-102 & 103)

SUMMARY

The Thermal Metal Wash (TMW) unit closed vent system collects vent gases from venturis, scrubbers, tank, and hoods as well as a temporary connection to the B200 tank farm in the event of the B100 and B200 closed vent system failure. This closed vent system is designed to operate with no detectable emissions, in accordance with Reg. 23, Section 264.1033(k)(1). Vent gases are treated in one of the TMW thermal vapor incinerators (control devices) known as thermal oxidation units (TOU) TOU-102 and 103. The control devices are designed to provide a minimum residence time of 0.75 seconds at a minimum temperature of 816°C (1,500°F) in accordance with ADEQ air permit requirements (NSPS)[1].

Both control devices referenced in this assessment are designed to operate at a nominal 900 scfm and to be operationally identical. Generally, TOU-103 operates as the primary device controlling vent gases generated from the TMW and TOU-102 operates as the backup to TOU-103. In the event of control device failure of B100 and B200 closed vent system, a vent connection from the B200 Tank farm can divert continuous vent sources associated with stored liquids to TOU-102 or TOU-103.

This assessment presents the documentation of compliance as required by §264.1035(b)(2) and (b)(4)(iii)(A), including an evaluation of the TMW closed vent system and control device requirements based on processes and conditions described by Rineco as representing conditions that result in maximum organic emissions[2]. A determination of relative TOU size is presented as necessary to meet the requisite minimum residence time and temperature during these conditions. The design and construction of each TOU is defined and guaranteed by the manufacturer. Evaluation of the overall system design gives operating performance and capacity requirements for proper emission control.

Several representative gas stream constituents and concentrations are selected for the varying conditions that could exist within the typical operating parameters of the TMW equipment. These varying parameters are presented in tables in Supplement 1.

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[1] The design of the control devices (thermal vapor incinerators) at Rineco are required to meet the more stringent requirements of 0.75 seconds residence time at 816°C combustion temperature due to air permitting requirements, as presented in the evaluation, in lieu of APC&EC Regulations 23, Section 264.1033(c) that requires only 0.50 seconds residence time at 760°C. It is presumed that compliance with these design parameters will result in control device operational efficiencies of 95% or greater.

[2] Refer to the Part B, Section A for owner/operator certification in accordance with Reg. 23, Section 264.1035(b)(4)(iv) & (v).

To simplify several operational scenarios, three VOC constituents are selected for combustion calculations to determine combustion air requirements and combustion chamber and burner sizing. Dimethyl Ether is selected due to its typical presences of combustion products in the TMW vent gas stream. Butane is selected due to its typical presence as a VOC with a high BTU content. And, Phenanthrene is selected due to the potential of its presence as a high temperature evaporated hydrocarbon in the final stages of the separation process. These scenarios represent cases when large amounts of secondary cooling air and a large combustion chamber volume would be required to prevent overheating of the combustion chamber at a typical refractory manufacturer specified temperature of 2,000°F.

Tabular results of the combustion calculations are also presented with the varying parameters. This data represents the information required for the relative sizing of a nominal 900 scfm unit. The thermal oxidizers are provided with corrosive resistant exteriors (e.g., stainless steel, polymer, etc.) due to the potential of corrosive combustion products.

TMW CLOSED VENT COLLECTION SYSTEM CAPACITY

The TMW closed-vent system collects vent gases from the venturi scrubbers and passes through a series of final scrubbers and separators before being conveyed by blowers onto the TOU-102 and TOU-103. The vented gas from each venturi unit varies considerably in rates and makeup during material processing in the TMW. For example, the gas venting from the processing of metal containers with propellants can significantly differ from shredded metal drums while the hooded processes from the solids transfer points are expected to vent little to no VOC content. Venting rates from these components are demonstrated below and tabulated in Supplement 1.

The TMW utilizes thermal conveyance to heat shredded material above the vaporization temperature. Volatile materials are evaporated from the shredded material while the remaining solids are charred or removed. The volatiles are removed from the off gas stream by condensation and separation. Residual non-condensable gases are vented to TOU-102 and TOU-103. A collection Tank (T-401) accumulates spray and recovered liquids from the TMW separators. This tank is approximately 6000 gallon capacity and can be pumped into or away from. These closed vent sources comprise a volumetric rate of approximately 900 cfm or less to TOU-102 or TOU-103. Hoods located at solids transfer points on the TMW collect vented atmosphere that is conveyed to the TOU's in a separate piping system as a source of combustion air. In the event of a VOC release within the hood collection system, an inline condenser will collect and remove any condensable hydrocarbon.

As discussed earlier, in the event of B100 and B200 closed vent system failure, tank venting from the building 200 tank farm can be diverted to the TMW closed vent system until the B100 and B200 closed vent system can be repaired. At this time the vent stream from the TMW will be operated at a reduced capacity. The twelve storage tanks in Building 200 each have a volume of 29,400 gallons. API 2000 states that for every

2,500 gallons in an externally exposed atmospheric storage tank 1 cfm of venting will occur due to exhaling and evaporation. This factor is intended for unsheltered tanks which can experience a 60°F surface temperature change during the day. The tanks in Building 200 are sheltered and are not exposed to such a varying daily temperature. The factors presented in API 2000 are conservative however will be utilized for this assessment. Therefore, each Building 200 tank is considered capable of 11.6 cfm of venting due to exhaling and evaporation for the total venting rate of 140 cfm.

The accumulated total for the TMW normal venting system from these described processes is approximately 900 cfm. These normal loads are contributed from the continuous operation of the TMW. Temporary vent rates are considered to result from the storage and transfer of liquids in the Building 200 tank system.

VENT GAS COMPOSITION

Rineco collects and analyzes liquids samples prior to separation from metal containers. These liquids demonstrate properties most similar to propellants and solvents. From these two were selected as a basis for this assessment[1]: Dimethyl Ether and Butane. These constituents were used in the combustion calculations that were compiled as the TMW TOU assessment. Also as discussd, Phenanthrene was selected as a potential VOC present as a high temperature (greater than 640 F) evaporated hydrocarbon. Although, it is expected that Phenanthrene will rapidly condense on any cool surface and will be removed from the vent stream. However, Phenanthrene in minor amounts were included in the assessment calculations as conservative. An example of these calculation are presented in Supplement 2.

The storage tanks connected to the closed vent system are also inerted with carbon dioxide and are considered sealed from air infiltration. Inerting gas is supplied to the tank atmosphere at a positive pressure for which the inerting gas acts as a vapor barrier over the fluid stored in the tank. Since the emissions of the tanks are removed from the top of each tank, the captured gas is estimated to be comprised of 70% to 82% of displaced and dissociated air and 3% to 15% VOC during pumping. Although heavier than air, it is estimated that 15% of the captured vent gas is carbon dioxide. This air is expected to enter the tank from the opening of manways for periodic sampling and maintenance, and from release of air entrapped in liquids pumped into the tanks.

The TMW is expected to condense and capture the bulk of all VOC from the thermal process, however, to be conservative, a 18% VOC composition on vent gases from condensers and separators is assumed. For additional conservatism and simplicity, the additional by-products or non-condensibles will be assumed to be part of the make up of the VOC stream. It is also expected that 15% of the vent gas is made up of inerting carbon dioxide gas for continuous inerting that takes place within the thermal process in the feed enclosure. The balance would be comprised of nitrogen and oxygen from inlet air.

It is also expected that minor amounts of particulate matter may be present as collected in the hoods around the magnet and shaker screens of the TMW. A wet dust collector is provided for removal of particulate to a minimum efficiency of 95%.

Planned testing will document compliance of less than 0.08 grains per dry standard cubic feet (gr/dscf) in the overall oxidizer stack gas stream.

VENT GAS COMBUSTION

The requirements for capture and control of VOC vent gas streams at Rineco include Regulation 23, Section 264, Subsections AA and CC, as well as New Source Performance Standards (NSPS) incorporated in the state air permit issued to Rineco. The specific control device technology utilized is thermal vapor incineration, the minimum design requirements of which vary by regulatory program. Since the state air permit standards are the more stringent of the two (0.75 seconds residence time at 816°C combustion temperature vs. 0.5 second residence time at 760°C), these are used as the basis for the control device assessment and design requirements.

For thermal oxidation of VOC, the EPA Air Pollution Training Institute Course 415 Control of Gaseous Emissions requires a combustion unit of sufficient capacity to operate at 816°C (1,500°F) and 0.75 seconds residence time to ensure 95% control of VOC vent streams. Therefore by documenting that the control devices meet the requisite residence time and combustion temperature, based on vent composition conditions required, it is presumed that 95% control of the vent streams is accomplished.

The calculations regarding TOU sizing and performance are tabulated in Attachment 1. Examples of the spreadsheet calculations are included in Attachment 2. These calculations quantify the constituents of the vent gas stream, developed above, in a molar fraction to determine design requirements of the TOU to maintain a minimum residence time of 0.75 seconds at 816°C. This brief description of the combustion of the vent gas outlines sample calculations included in Attachment 2. These calculations are intended to establish the relative size and expected performance of the TOUs. The design and construction of the TOU arrangement is then specified by the manufacturer based on the required performance specifications developed herein.

From the volumes and composition of vent gas determined above, the constituents are broken out in a molar fraction to determine the mass flow of each constituent from ideal gas laws. From the VOC constituent, the heat content and heat released is determined from empirically deriving the products of combustion and the enthalpy of formation (Perry's Chemical Engineer's Handbook, 6th Edition). This empirical formula determines the required oxygen, which also determines the addition of primary combustion air required. Next, the heat addition to the vent gas stream, the primary combustion air stream, and the combustion product stream to achieve the proper combustion temperature and required resident temperature is determined from the specific heat constants of each constituent. The calculated heat required is subtracted from the heat generated by the combustion of the VOC constituent. If the heat from VOC combustion is in excess to the heat required to raise and maintain all constituents at the resident temperature, the amount of secondary air required to remove the excessive heat is determined. However, if the VOC combustion heat is insufficient to achieve and maintain the resident temperature, required supplemental heat addition from the combustion of natural gas is determined. Should the combustion of natural gas prove to be necessary, primary combustion air and secondary cooling air is calculated from the consumption rates of the natural gas. Upon completion of all above described calculations, the total combustion stream from the closed vent gas and the natural gas is determined as volumetric and mass flow. The volumetric rate determines the combustion chamber volume required to achieve the minimum resident time of all gas streams.

CONCLUSIONS

Rineco desires to provide for control of the facility closed-vent gas streams through the use of thermal vapor incineration technology. Thus the units must be designed to maintain the vent gas stream flows at a minimum temperature of 816°C (1,500°F) for at least 0.75 seconds residence time. According to waste composition and equipment operational data provided by Rineco[3], each of the TMW control devices must be designed to treat a minimum vent gas flow rate of 900 cubic feet per minute with a composition of 18% VOC (butane), 15% carbon dioxide, and 67% air. From these calculations, each control device (TOU) should have a minimum combustion chamber volume of 735 cubic feet.

REGISTERED ENGINEER CERTIFICATION:

I certify under penalty of law that this subject document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Frank A. Porbeck, PE
Porbeck Engineering Corporation

[3] The calculations included in this assessment are based on information supplied by Rineco, in accordance with Reg. 23, Section 264.1035(b)(2), including the referenced data analysis of samples randomly collected from liquids in tank storage.

Additional Information Included in this Assessment:

Figures	Description
091	General Arrangement; Thermal Oxidizer Unit (TOU-102)
092	General Arrangement; Thermal Oxidizer Unit (TOU-103)

Supplement	Description
1	Tables 1 through 4; Tabulations of Alternative Calculations Re: TOU Sizing & Performance
2	Example Spreadsheets Re: TOU Combustion Calculations

Supplement 1

TABLE-1

900 CFM CLOSED VENT AND TOU CALCULATIONS FOR TMW WITH DIMETHYL ETHER AS VOC

TOU & Vent Stream

Temprature Required	1500 deg F
Retention Time	0.75 sec
Estimated Peak Burner Rate	5 MMBTU/hr
Estimated Stack Diameter	6.75 ft

			TOU Loading		
Thermal Metal Wash #1	Operating	Vent Loading (cfm)	Carbon Dioxide Content (%)	VOC* Content (%)	Air Content (%)
Vent from TMw	1	900.0	15.0%	18.0%	67.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	Subtotal =	900.0	15.0%	18.0%	67.0%

Closed Vent & TOU Calculations

Peak Vent Rate	=	900.00 cfm
VOC* Content	=	18.000%
Carbon Dioxide Content	=	15.000%
Air Content	=	67.000%
Total Gas Flow through Chamt	=	28598 acfm
Combustion Chamber Volume	=	357.5 cu ft
Combustion Chamber Diamete	=	4.5 ft
Combustion Chamber Height	=	22.5 ft
Natural Gas Consumption	=	16 scfd
Burner Heat Generation	=	0.00 MMBTU/hr
Primary Air Required	=	1728 acfm
Secondary Cooling Air	=	4843 acfm
Stack Velocity	=	13 ft/s
Heat Released from VOC	=	14.19 MMBTU/hr

*** Dimethyl Ether (BY VOLUME)**

Supplement 1

TABLE-2

900 CFM CLOSED VENT AND TOU CALCULATIONS FOR TMW WITH BUTANE AS VOC

TOU & Vent Stream

Temprature Required	1500 deg F
Retention Time	0.75 sec
Estimated Peak Burner Rate	5 MMBTU/hr
Estimated Stack Diameter	6.75 ft

			TOU Loading		
Thermal Metal Wash #1	Operating	Vent Loading (cfm)	Carbon Dioxide Content (%)	VOC* Content (%)	Air Content (%)
Vent from TMW	1	900.0	15.0%	18.0%	67.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	Subtotal =	900.0	15.0%	18.0%	67.0%

Closed Vent & TOU Calculations

Peak Vent Rate	=	900.00 cfm
VOC* Content	=	18.000%
Carbon Dioxide Content	=	15.000%
Air Content	=	67.000%
Total Gas Flow through Chamb	=	58776 acfm
Combustion Chamber Volume	=	734.7 cu ft
Combustion Chamber Diamete	=	6.4 ft
Combustion Chamber Height	=	22.5 ft
Natural Gas Consumption	=	16 scfd
Burner Heat Generation	=	0.00 MMBTU/hr
Primary Air Required	=	4438 acfm
Secondary Cooling Air	=	10092 acfm
Stack Velocity	=	27 ft/s
Heat Released from VOC	=	28.90 MMBTU/hr

*** BUTANE (BY VOLUME)**

Supplement 1

TABLE-3

900 CFM CLOSED VENT AND TOU CALCULATIONS FOR TMW WITH PHENANTHRENE AS VOC

TOU & Vent Stream

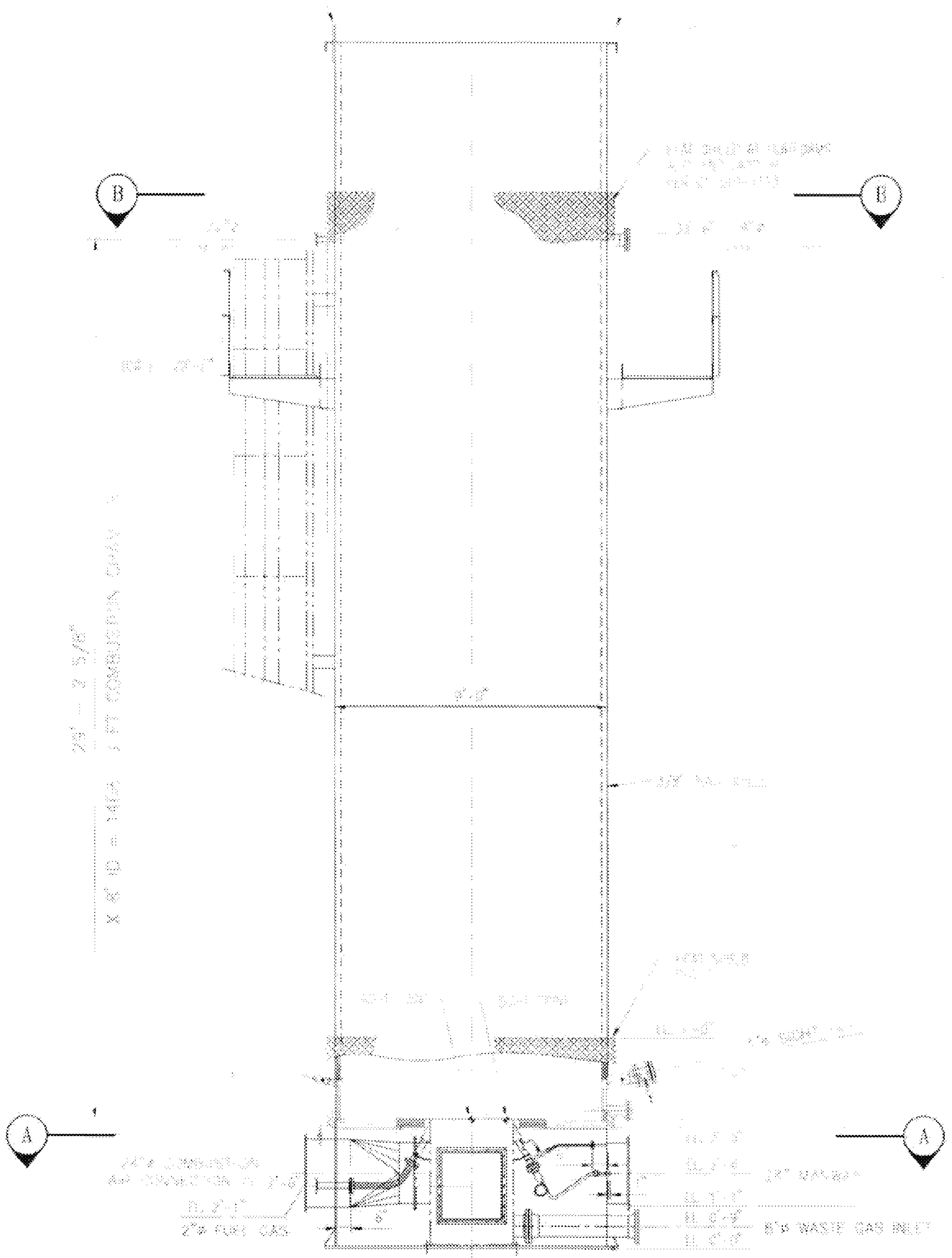
Temprature Required	1500 deg F
Retention Time	0.75 sec
Estimated Peak Burner Rate	5 MMBTU/hr
Estimated Stack Diameter	6.75 ft

			TOU Loading		
Thermal Metal Wash #1	Operating	Vent Loading (cfm)	Carbon Dioxide Content (%)	VOC* Content (%)	Air Content (%)
Vent from TMW	1	900.0	15.0%	1.0%	84.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	Subtotal =	900.0	15.0%	1.0%	84.0%

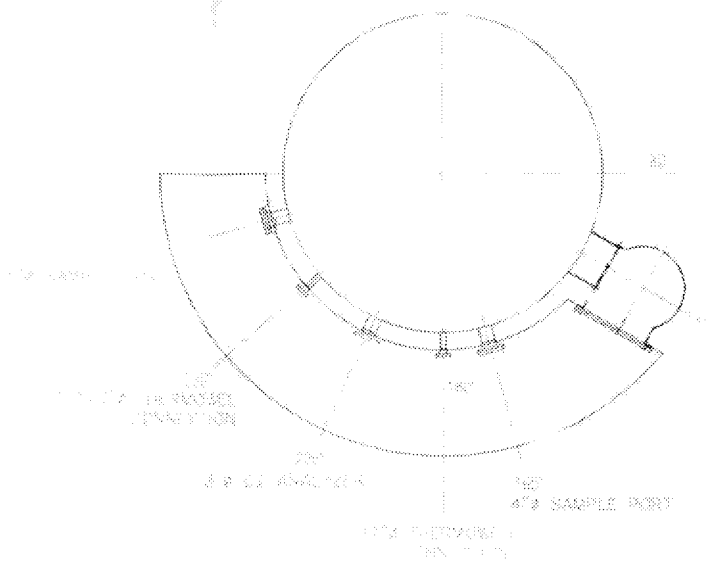
Closed Vent & TOU Calculations

Peak Vent Rate	=	900.00 cfm
VOC* Content	=	1.000%
Carbon Dioxide Content	=	15.000%
Air Content	=	84.000%
Total Gas Flow through Chamb	=	8988 acfm
Combustion Chamber Volume	=	112.3 cu ft
Combustion Chamber Diamete	=	2.5 ft
Combustion Chamber Height	=	22.5 ft
Natural Gas Consumption	=	16 scfd
Burner Heat Generation	=	0.00 MMBTU/hr
Primary Air Required	=	0 acfm
Secondary Cooling Air	=	1494 acfm
Stack Velocity	=	4 ft/s
Heat Released from VOC	=	4.45 MMBTU/hr

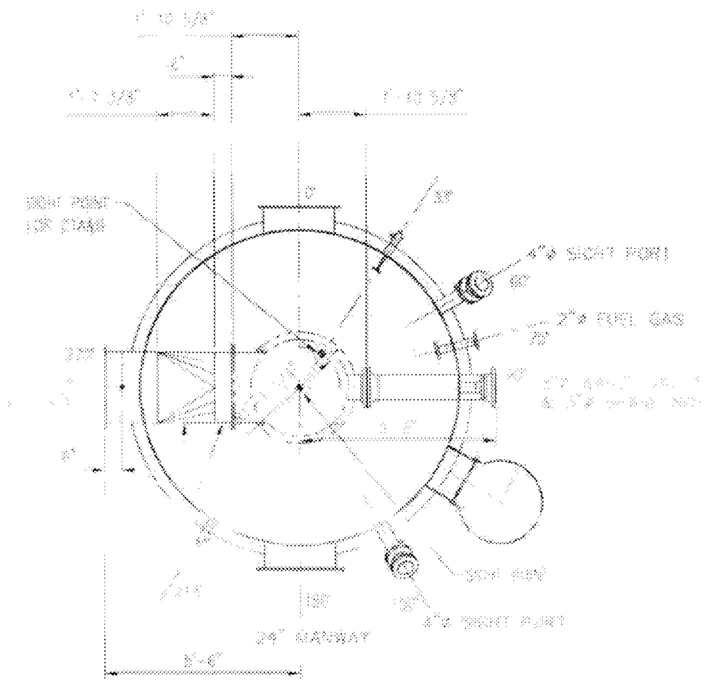
*** PHENANTHRENE (BY VOLUME)**



ELEVATION



VIEW "B-B"



VIEW "A-A"

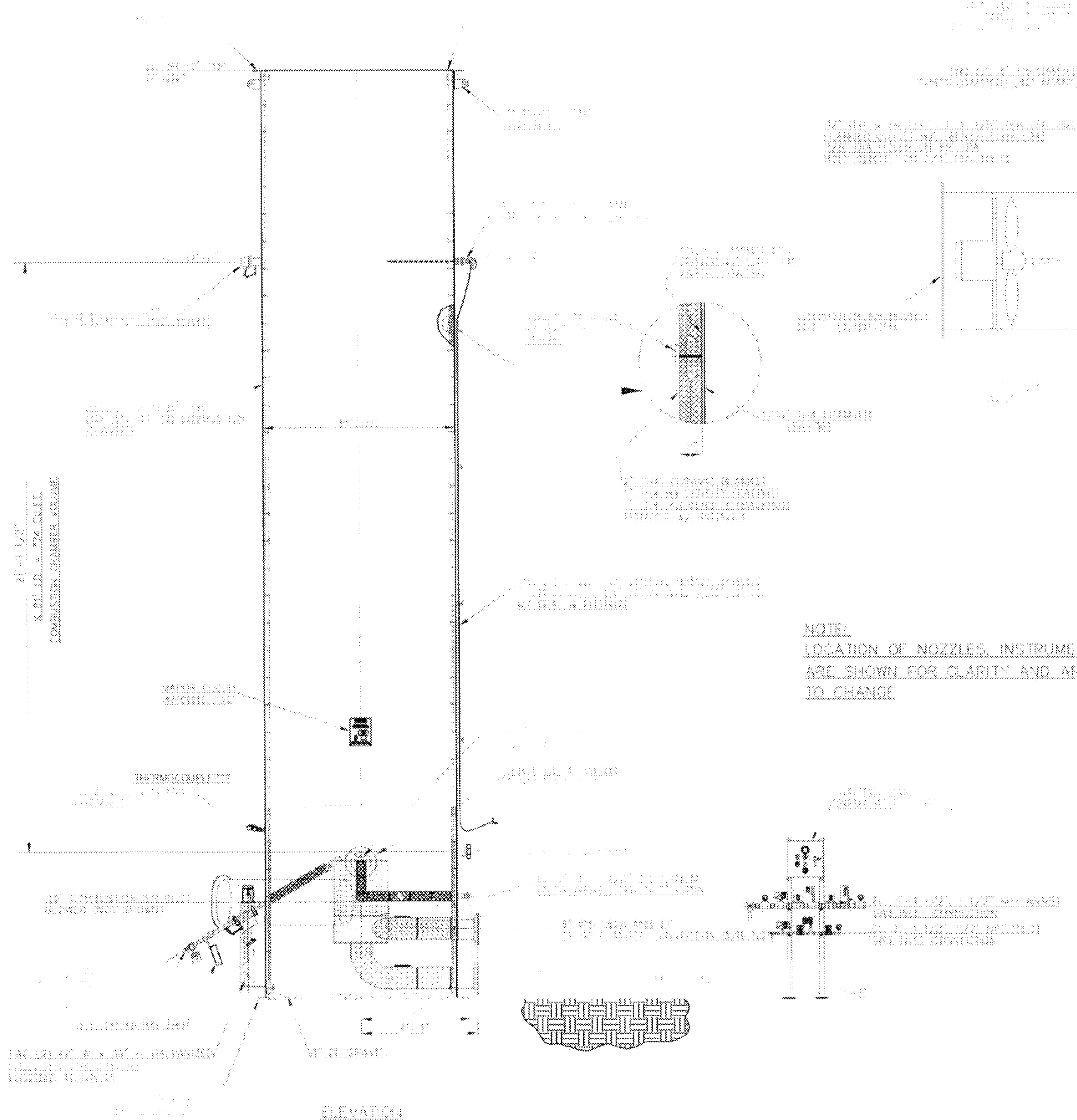
NOTE:
CONFIGURATION OF OXIDIZER PRESENTED MAY VARY FROM SELECTED GUARANTEED MANUFACTURER'S DESIGN

FIG. NO. 092 | PART B | REV. A

RINECO

GENERAL ARRANGEMENT
THERMAL OXIDIZER UNIT
TOU-103

STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No. 8024 TED R. TAYLOR



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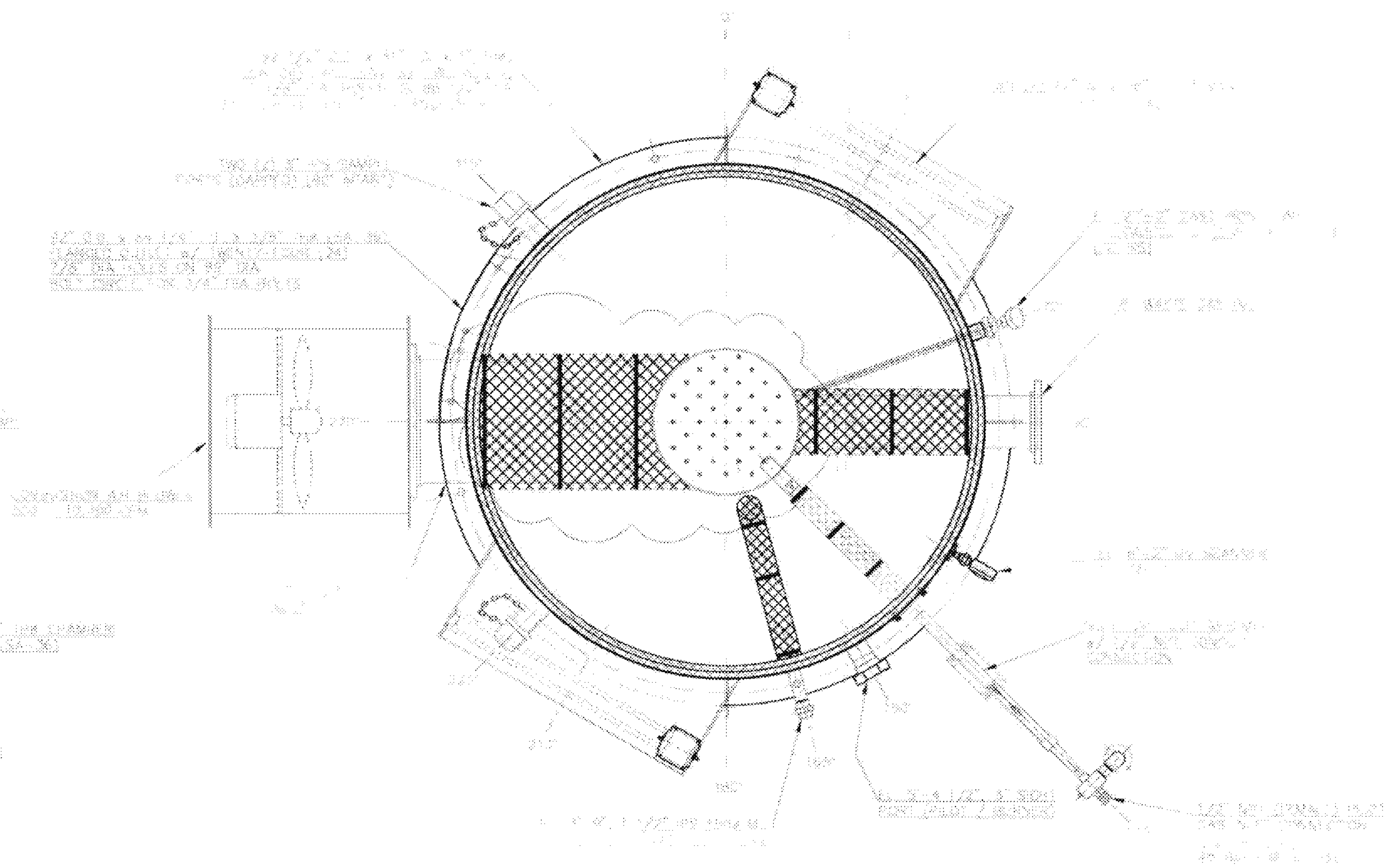

PLAN VIEW

NOTE:
LOCATION OF NOZZLES, INSTRUMENTS, LOUVRES, ETC.
ARE SHOWN FOR CLARITY AND ARE SUBJECT
TO CHANGE

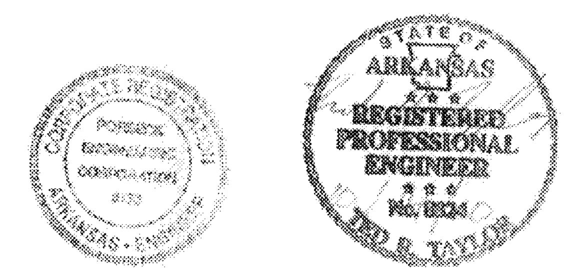

FIG. NO. 09I	PART B	REV. A

RINECO

GENERAL ARRANGEMENT
THERMAL OXIDIZER UNIT
TOU-102

FIG NO. 09'

Supplement 1

TABLE-4

900 CFM CLOSED VENT AND TOU CALCULATIONS FOR TMW WITH CO2 ONLY

TOU & Vent Stream	
Temprature Required	1500 deg F
Retention Time	0.75 sec
Estimated Peak Burner Rate	5 MMBTU/hr
Estimated Stack Diameter	6.75 ft

			TOU Loading		
Thermal Metal Wash #1	Operating	Vent Loading (cfm)	Carbon Dioxide Content (%)	VOC* Content (%)	Air Content (%)
Vent from TMW	1	900.0	100.0%	0.0%	0.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	0	0.0	0.0%	0.0%	100.0%
	Subtotal =	900.0	100.0%	0.0%	0.0%

Closed Vent & TOU Calculations		
Peak Vent Rate	=	900.00 cfm
VOC* Content	=	0.000%
Carbon Dioxide Content	=	100.000%
Air Content	=	0.000%
Total Gas Flow through Chamt	=	5562 acfm
Combustion Chamber Volume	=	69.5 cu ft
Combustion Chamber Diamete	=	2.0 ft
Combustion Chamber Height	=	22.5 ft
Natural Gas Consumption	=	78578 scfd
Burner Heat Generation	=	3.35 MMBTU/hr
Primary Air Required	=	539 acfm
Secondary Cooling Air	=	0 acfm
Stack Velocity	=	3 ft/s
Heat Released from VOC	=	0.00 MMBTU/hr

*** CO2 ONLY**

THERMAL OXIDIZER UNIT - COMBUSTION CALCULATIONS

INPUT DATA

18%	OF THE CLOSED VENT SYSTEM VAPORS ARE VOCs
15%	OF THE CLOSED VENT SYSTEM VAPORS IS CARBON DIOXIDE
0.67	OF THE CLOSED VENT SYSTEM VAPORS IS AIR
900.00	SCFM IS THE TYPICAL FLOW RATE FOR THE CLOSED VENT SYSTEM
0.05	OF ALL COMBUSTION HEAT IS LOST THROUGH THE COMBUSTION CHAMBER WALLS
1500	DEG F = REQUIRED COMBUSTION CHAMBER EXIT TEMPERATURE

OUTPUT DATA

28895320.40 BTU/HOUR = HEAT RELEASED FROM VOC COMBUSTION
4437.52 ACFM OR 266251.18 ACFH = PRIMARY COMBUSTION AIR NEEDED FOR VOC COMBUSTION
10091.64 ACFM OR 605498.32 ACFH = SECONDARY COMBUSTION AIR NEEDED FOR VOC COMBUSTION
1178.51 LB/MIN = TOTAL GAS FLOW DUE TO VOC COMBUSTION
58774.37 ACFM = TOTAL GAS FLOW DUE TO VOC COMBUSTION (AT 1500.00 DEG F)
5 MMBTU/HOUR BURNER MAXIMUM CAPACITY 166.67
666.67 BTU/HOUR = HEAT RELEASED FROM NATURAL GAS COMBUSTION (ADJUSTED SO THAT SECONDARY COMBUSTION AIR DEMAND = 0)
15.64 SCFD = NATURAL GAS CONSUMPTION
0.11 ACFM OR 6.44 ACFH = PRIMARY COMBUSTION AIR NEEDED FOR NATURAL GAS COMBUSTION
0.24 ACFM OR 14.62 ACFH = SECONDARY COMBUSTION AIR NEEDED FOR NATURAL GAS COMBUSTION
0.03 LB/MIN = TOTAL GAS FLOW DUE TO NATURAL GAS COMBUSTION
1.36 ACFM = TOTAL GAS FLOW DUE TO NATURAL GAS COMBUSTION (AT 1500.00 DEG F)

1178.53 LB/MIN = OVERALL GAS FLOW
14529.51 ACFM OR 871770.56 ACFH = TOTAL AIR NEEDED
58775.73 ACFM = OVERALL GAS FLOW (AT 1500.00 DEG F)
0.75 SECONDS = COMBUSTION CHAMBER RESIDENCE TIME
30.00 FEET/SECOND = COMBUSTION CHAMBER VELOCITY
27.37 FEET/SECOND = STACK VELOCITY

1. CLOSED VENT SYSTEM MATERIAL TO COMBUST

THE CLOSED VENT SYSTEM MATERIAL WILL BE EITHER CO2, N2, O2, H2O, VOCS, OR A COMBINATION.

BASED ON VOC ANALYSIS OF FUEL SAMPLES, THE MOST PREVALENT VOC IS BUTANE (C4H10) MOLECULAR WEIGHT = **58.12**

BUTANE COMBUSTION:	**1.00**	C4H10(g) +	6.50	O2 (g) -->	4.00	CO2(g) +	5.00	H2O(g)
ENTHALPY OF BONDS @ 298K, KCAL/GMOL		**-1235.92**		**-119.02**		**-384.80**		**-221.80**

C4H10 ENTHALPY OF COMBUSTION = 638.65 KCAL/GMOL = 1149570.00 BTU/LBMOL = 19779.25 BTU/POUND OF C4H10

1.A. CLOSED VENT SYSTEM VAPORS

COMPONENT	LB/MIN	LBMOL/MIN	WEIGHT PERCENT	MOLE PERCENT	DENSITY @ STP, LB/FT^3	GAS FLOW SCFM
CARBON DIOXIDE	15.36	0.35	0.18	0.15	0.11	135.00
NITROGEN	34.07	1.22	0.40	0.52	0.07	470.26
OXYGEN	10.29	0.32	0.12	0.14	0.08	124.36
WATER	0.39	0.02	0.00	0.01	0.05	8.38
BUTANE	24.35	0.42	0.29	0.18	0.15	162.00
TOTALS	84.46	2.33	1.00	1.00		900.00

THERMAL OXIDIZER UNIT - COMBUSTION CALCULATIONS

2. CALCULATION OF PRIMARY COMBUSTION AIR NEEDED FOR COMBUSTION OF VOCs

COMBUSTION AIR BASIS:	60.00	DEGREES F AND	0.23	(BY WEIGHT) OR	0.21	OXYGEN CONTENT
	0.80	RELATIVE HUMIDITY	0.01	(BY WEIGHT) OR	0.01	WATER CONTENT
			0.76	(BY WEIGHT) OR	0.78	NITROGEN CONTENT
			0.08	POUNDS/CU.FT. (MOIST AIR) DENSITY		

	LB/MIN	LBMOL/MIN	O2 LBMOL REQUIRED	O2 LB REQUIRED	LB O2/ LB AIR	LB AIR REQUIRED	HEAT OF COMBUSTION BTU/LB	NET HEAT BTU/MIN	COMBUSTION PRODUCTS, LB/MIN CO2 (g)	H2O (g)	Extra	TOTAL
COMBUSTIBLES IN CLOSED VENT SYSTEM GASES												
BUTANE	24.35	0.42	2.72	87.13	0.23	378.89	19779.25	481588.67	73.75	37.74	0.00	111.48
TOTALS			2.72	87.13		378.89		481588.67	73.75	37.74	0.00	111.48

76.84 LB/MIN = NET OXYGEN REQUIRED (AFTER CONSUMING OXYGEN PRESENT IN CLOSED VENT SYSTEM STREAM)
334.15 LB/MIN = NET AIR REQUIRED (AFTER CONSUMING OXYGEN PRESENT IN CLOSED VENT SYSTEM STREAM)

	LB/MIN	LBMOL/MIN	WEIGHT PERCENT	MOLE PERCENT
PRIMARY COMBUSTION AIR FOR STOICHIOMETRIC COMBUSTION OF RESIDUAL MATERIAL				
OXYGEN	76.84	2.40	0.23	0.21
WATER	2.91	0.16	0.01	0.01
NITROGEN	254.39	9.08	0.76	0.78
TOTALS	334.15	11.64	1.00	1.00

PRIMARY COMBUSTION AIR REQUIRED 334.15 POUNDS/MINUTE OR 4437.52 ACFM

3. COMBUSTION GASES STREAM FROM VOC COMBUSTION ONLY - STOICHIOMETRIC COMBUSTION

	LB/MIN	LBMOL/MIN	WEIGHT PERCENT	MOLE PERCENT
VOC COMBUSTION GASES				
CARBON DIOXIDE	73.75	1.68	0.22	0.14
NITROGEN	288.46	10.30	0.86	0.85
OXYGEN	-66.55	-2.08	-0.20	-0.17
WATER	3.30	0.18	0.01	0.02
H20 (Combust Prd)	37.74	2.09	0.11	0.17
TOTALS	336.69	12.17	1.00	1.00

BTU Content of Inlet Gas (BTU/CF)
535.10

4. CALCULATION OF SURPLUS HEAT GENERATED BY COMBUSTED VOCs

4.A. CALCULATION OF HEAT TO ADD TO INLET STOICHIOMETRIC STREAM

	INLET TEMP DEG F	INLET TEMP DEG K	OUTLET TEMP DEG F	OUTLET TEMP DEG K	POUNDS/ MINUTE	LBMOLES/ MINUTE	WEIGHT PERCENT	MOLE PERCENT	SPECIFIC HEAT BTU/LB-F	HEAT TO ADD BTU/MIN
INLET STREAM - STOICHIOMETRIC COMBUSTION, SENSIBLE HEAT TO ADD TO REACH DESIRED COMBUSTION TEMPERATURE										
CARBON DIOXIDE	60.00	288.56	77.00	298.00	15.36	0.35	0.04	0.02	0.20	52.65
NITROGEN	60.00	288.56	77.00	298.00	34.07	1.22	0.08	0.09	0.24	140.44
OXYGEN	60.00	288.56	77.00	298.00	10.29	0.32	0.02	0.02	0.24	42.64
WATER	60.00	288.56	77.00	298.00	0.39	0.02	0.00	0.00	0.48	3.21
BUTANE	60.00	288.56	77.00	298.00	24.35	0.42	0.06	0.03	0.39	161.43
OXYGEN	60.00	288.56	77.00	298.00	76.84	2.40	0.18	0.17	0.24	318.44
WATER	60.00	288.56	77.00	298.00	2.91	0.16	0.01	0.01	0.48	23.99
NITROGEN	60.00	288.56	77.00	298.00	254.39	9.08	0.61	0.65	0.24	1048.72
TOTALS					418.61	13.97	1.00	1.00	0.25	1791.52

THERMAL OXIDIZER UNIT - COMBUSTION CALCULATIONS

4.B. CALCULATION OF HEAT TO ADD TO OUTLET STREAM

	INLET TEMP DEG F	INLET TEMP DEG K	OUTLET TEMP DEG F	OUTLET TEMP DEG K	POUNDS/ MINUTE	LBMOLES/ MINUTE	WEIGHT PERCENT	MOLE PERCENT	SPECIFIC HEAT BTU/LB-F	HEAT TO ADD BTU/MIN
OUTLET STREAM - STOICHIOMETRIC COMBUSTION, SENSIBLE HEAT REQUIRED TO REACH DESIRED OUTLET TEMPERATURE										
CARBON DIOXIDE	77.00	298.00	1500.00	1088.56	89.11	2.02	0.21	0.14	0.23	29797.26
NITROGEN	77.00	298.00	1500.00	1088.56	288.46	10.30	0.69	0.71	0.26	105400.86
OXYGEN	77.00	298.00	1500.00	1088.56	0.00	0.00	0.00	0.00	0.26	0.00
WATER	77.00	298.00	1500.00	1088.56	3.30	0.18	0.01	0.01	0.61	2844.65
H2O (combust prdt)	77.00	298.00	1500.00	1088.56	37.74	2.09	0.09	0.14	0.61	32489.79
TOTALS					418.61	14.60	1.00	1.00	0.29	170532.55

4.C. EXCESS HEAT FROM VOC COMBUSTION ONLY - REMOVED BY SECONDARY AIR

481588.67	BTU/MIN COMBUSTION HEA	28.90 MM BTU/HOUR)
-1791.52	BTU/MIN HEAT TO ADD TO INLET GAS STREAM TO HEAT IT TO COMBUSTION REFERENCE TEMPERATURE	
-170532.55	BTU/MIN HEAT TO ADD TO OUTLET GAS STREAM TO HEAT IT TO BURNER OUTLET TEMPERATURE	
-24079.43	BTU/MIN LOST IN COMBUSTION CHAMBEI	(0.05 OF THE COMBUSTION HEAT IS LOST)
285185.17	BTU/MIN HEAT TO REMOVE WITH SECONDARY AIR	

375.29 BTUs WILL BE REMOVED BY 1.00 POUND OF SECONDARY AIR
759.90 LB/MIN OF SECONDARY AIR WILL BE NEEDED TO COOL THE COMBUSTION GASES TO THE DESIRED OUTLET TEMPERATURE

	INLET TEMP DEG F	INLET TEMP DEG K	OUTLET TEMP DEG F	OUTLET TEMP DEG K	POUNDS/ MINUTE	WEIGHT PERCENT	SPECIFIC HEAT BTU/LB-F	HEAT REMOVED BTU/HOUR	DENSITY @ STP, LB/FT^3	GAS FLOW CU.FT. @ STP
SECONDARY AIR STREAM										
OXYGEN	60.00	288.56	1500.00	1088.56	174.75	0.23	0.26	-65655.95	0.08	2110.00
WATER	60.00	288.56	1500.00	1088.56	6.63	0.01	0.60	-5754.42	0.05	140.00
NITROGEN	60.00	288.56	1500.00	1088.56	578.52	0.76	0.26	-213774.80	0.07	7990.00
TOTALS					759.90	1.00	0.26	-285185.17		10240.00

334.15	LB/MIN = PRIMARY COMBUSTION AIR REQUIRED OR	4437.52	ACFM	0.31	= % AIR (PRIMARY)
759.90	LB/MIN = SECONDARY COMBUSTION AIR REQUIRED OR	10091.64	ACFM	0.69	= % AIR (SECONDARY)
1094.05	LB/MIN = TOTAL COMBUSTION AIR REQUIRED OR	14529.16	ACFM	1.00	= % AIR (TOTAL)

4.D. COMBINED OUTLET STREAM - VOC COMBUSTION ONLY

	LB/MIN	LBMOL/MIN	WEIGHT PERCENT	MOLE PERCENT	DENSITY @ STP, LB/FT^3	GAS FLOW CFM. @ STP	GAS FLOW, ACFM @ 1500.00 DEG F	
OUTLET STREAM - STOICHIOMETRIC COMBUSTION MIXTURE PLUS SECONDARY AIR								
CARBON DIOXIDE	89.11	2.02	0.08	0.05	0.11	783.00	2896.94	CARBON DIOXIDE
NITROGEN	866.97	30.95	0.74	0.75	0.07	11967.81	44278.45	NITROGEN
OXYGEN	174.75	5.46	0.15	0.13	0.08	2111.88	7813.51	OXYGEN
WATER	9.93	0.55	0.01	0.01	0.05	213.16	788.63	WATER
H2O (Combust Prd)	37.74	2.09	0.03	0.05	0.05	810.00	2996.85	H2O (Combust Prd)
TOTALS	1178.51	41.08	1.00	1.00		15885.85	58774.37	

THERMAL OXIDIZER UNIT - COMBUSTION CALCULATIONS

5. NATURAL GAS COMBUSTION

5.A. NATURAL GAS COMBUSTION - REQUIRED FLOW RATE FOR MAXIMUM HEAT OUTPUT

5.00 MM BTU/HOUR = THE BURNER'S MAXIMUM HEAT OUTPUT
0.00 MM BTU/HOUR = BURNER'S HEAT OUTPUT DUE TO NATURAL GAS COMBUSTION

386.70 STD FT^3/LBMOLE = GAS DENSITY OF NATURAL GAS (STANDARD CONVERSION)
17.25 LB/LBMOL = TYPICAL NATURAL GAS MOLECULAR WEIGHT (CALCULATED FROM DALLAS, TX DATA GIVEN IN PERRY'S CHEMICAL ENGINEERS' HANDBOOK, 6th ed.)

22931.98 BTU/LB = GROSS HEATING VALUE (CALCULATED FROM DALLAS, TX DATA NOTED ABOVE)
1023.24 BTU/SCF = GROSS HEATING VALUE (CALCULATED FROM DALLAS, TX DATA NOTED ABOVE)

0.00 LB/MIN = REQUIRED NATURAL GAS CONSUMPTION RATE

	LB/MIN	LBMOL/MIN	WEIGHT PERCENT	MOLE PERCENT	HEAT OF COMBUSTION BTU/LB
TYPICAL NATURAL GAS FLOW (BASED ON DATA FOR DALLAS, TX NATURAL GAS)					
METHANE	0.00	0.00	**0.86**	0.93	**23861.00**
ETHANE	0.00	0.00	**0.07**	0.04	**22304.00**
PROPANE	0.00	0.00	**0.03**	0.01	**21646.00**
BUTANE	0.00	0.00	**0.00**	0.00	**21293.00**
PENTANE	0.00	0.00	**0.00**	0.00	**21072.00**
HEXANE	0.00	0.00	**0.00**	0.00	**20928.00**
CARBON DIOXIDE	0.00	0.00	**0.01**	0.00	0.00
NITROGEN	0.00	0.00	0.02	0.02	0.00
TOTALS	0.00	0.00	1.00	1.00	22931.98

5.B. CALCULATION OF PRIMARY COMBUSTION AIR NEEDED

COMBUSTION AIR BASIS: 60.00 DEGREES F AND
0.80 RELATIVE HUMIDITY

0.23 OXYGEN CONTENT
0.01 WATER CONTENT
0.76 NITROGEN CONTENT
0.08 POUNDS/CU.FT. (MOIST AIR) DENSITY

	LB/MIN	LBMOL/MIN	O2 LBMOL REQUIRED	O2 LB REQUIRED	LB O2/ LB AIR	LB AIR REQUIRED	HEAT OF COMBUSTION BTU/LB	NET HEAT BTU/MIN	COMBUSTION PRODUCTS, LB/MIN CO2 (g)	H2O (g)	TOTAL
COMBUSTIBLES IN NATURAL GAS											
METHANE	0.00	0.00	0.00	0.00	0.23	0.01	23861.00	9.98	0.00	0.00	0.00
ETHANE	0.00	0.00	0.00	0.00	0.23	0.00	22304.00	0.78	0.00	0.00	0.00
PROPANE	0.00	0.00	0.00	0.00	0.23	0.00	21646.00	0.29	0.00	0.00	0.00
BUTANE	0.00	0.00	0.00	0.00	0.23	0.00	21293.00	0.05	0.00	0.00	0.00
PENTANE	0.00	0.00	0.00	0.00	0.23	0.00	21072.00	0.01	0.00	0.00	0.00
HEXANE	0.00	0.00	0.00	0.00	0.23	0.00	20928.00	0.00	0.00	0.00	0.00
TOTALS			0.00	0.00		0.01		11.11	0.00	0.00	0.00

	LB/MIN	LBMOL/MIN	WEIGHT PERCENT	MOLE PERCENT
PRIMARY COMBUSTION AIR FOR STOICHIOMETRIC COMBUSTION OF NATURAL GAS				
OXYGEN	0.00	0.00	0.23	0.21
WATER	0.00	0.00	0.01	0.01
NITROGEN	0.01	0.00	0.76	0.78
TOTALS	0.01	0.00	1.00	1.00

PRIMARY COMBUSTION AIR REQUIRED 0.01 POUNDS/MINUTE OR 0.11 ACFM

THERMAL OXIDIZER UNIT - COMBUSTION CALCULATIONS

5.C. CALCULATION OF SURPLUS HEAT GENERATED BY COMBUSTED NATURAL GAS

	INLET TEMP DEG F	INLET TEMP DEG K	OUTLET TEMP DEG F	OUTLET TEMP DEG K	POUNDS/ MINUTE	LBMOLES/ MINUTE	WEIGHT PERCENT	MOLE PERCENT	SPECIFIC HEAT BTU/LB-F	HEAT TO ADD BTU/MIN
INLET STREAM - STOICHIOMETRIC COMBUSTION, SENSIBLE HEAT TO ADD TO REACH DESIRED COMBUSTION TEMPERATURE										
METHANE	60.00	288.56	77.00	298.00	0.00	0.00	0.05	0.08	0.53	0.00
ETHANE	60.00	288.56	77.00	298.00	0.00	0.00	0.00	0.00	0.41	0.00
PROPANE	60.00	288.56	77.00	298.00	0.00	0.00	0.00	0.00	0.39	0.00
BUTANE	60.00	288.56	77.00	298.00	0.00	0.00	0.00	0.00	0.40	0.00
PENTANE	60.00	288.56	77.00	298.00	0.00	0.00	0.00	0.00	0.39	0.00
HEXANE	60.00	288.56	77.00	298.00	0.00	0.00	0.00	0.00	0.39	0.00
CARBON DIOXIDE	60.00	288.56	77.00	298.00	0.00	0.00	0.00	0.00	0.20	0.00
NITROGEN	60.00	288.56	77.00	298.00	0.00	0.00	0.00	0.00	0.24	0.00
OXYGEN (FROM AIR)	60.00	288.56	77.00	298.00	0.00	0.00	0.22	0.19	0.24	0.01
WATER (FROM AIR)	60.00	288.56	77.00	298.00	0.00	0.00	0.01	0.01	0.48	0.00
NITROGEN (FROM AIR)	60.00	288.56	77.00	298.00	0.01	0.00	0.72	0.71	0.24	0.03
TOTALS					0.01	0.00	1.00	1.00	0.26	0.04

	INLET TEMP DEG F	INLET TEMP DEG K	OUTLET TEMP DEG F	OUTLET TEMP DEG K	POUNDS/ MINUTE	LBMOLES/ MINUTE	WEIGHT PERCENT	MOLE PERCENT	SPECIFIC HEAT BTU/LB-F	HEAT TO ADD BTU/MIN
OUTLET STREAM - STOICHIOMETRIC COMBUSTION, SENSIBLE HEAT REQUIRED TO REACH DESIRED OUTLET TEMPERATURE										
CARBON DIOXIDE	77.00	298.00	1500.00	1088.56	0.00	0.00	0.15	0.10	0.23	0.44
OXYGEN	77.00	298.00	1500.00	1088.56	0.00	0.00	0.00	0.00	0.26	0.00
WATER	77.00	298.00	1500.00	1088.56	0.00	0.00	0.13	0.20	0.61	0.95
NITROGEN	77.00	298.00	1500.00	1088.56	0.01	0.00	0.72	0.71	0.26	2.25
TOTALS					0.01	0.00	1.00	1.00	0.30	3.63

5.D. EXCESS HEAT FROM NATURAL GAS COMBUSTION ONLY - REMOVED BY SECONDARY AIR

11.11	BTU/MIN COMBUSTION HEAT
-0.04	BTU/MIN HEAT TO ADD TO INLET GAS STREAM TO HEAT IT TO COMBUSTION REFERENCE TEMPERATURE
-3.63	BTU/MIN HEAT TO ADD TO OUTLET GAS STREAM TO HEAT IT TO BURNER OUTLET TEMPERATURE
-0.56	BTU/MIN LOST IN COMBUSTION CHAMBERS (0.05 OF THE COMBUSTION HEAT IS LOST)
0.00	BTU/MIN REQUIRED TO HEAT CLOSED VENT SYSTEM GASES

6.88	BTU/MIN HEAT TO REMOVE WITH SECONDARY AIR

375.29 BTUs WILL BE REMOVED B` 1.00 POUND OF SECONDARY AIR

0.02 LB/MIN OF SECONDARY AIR WILL BE NEEDED TO COOL THE COMBUSTION GASES TO THE DESIRED OUTLET TEMPERATURE

	INLET TEMP DEG F	INLET TEMP DEG K	OUTLET TEMP DEG F	OUTLET TEMP DEG K	POUNDS/ MINUTE	WEIGHT PERCENT	SPECIFIC HEAT BTU/LB-F	HEAT REMOVED BTU/HOUR	DENSITY @ STP, LB/FT^3	GAS FLOW SCFM
SECONDARY AIR STREAM										
OXYGEN	60.00	288.56	1500.00	1088.56	0.00	0.23	0.26	-1.59	0.08	0.00
WATER	60.00	288.56	1500.00	1088.56	0.00	0.01	0.60	-0.14	0.05	0.00
NITROGEN	60.00	288.56	1500.00	1088.56	0.01	0.76	0.26	-5.16	0.07	0.00
TOTALS					0.02	1.05	0.26	-6.88		0.00

0.01	LB/MIN = PRIMARY COMBUSTION AIR REQUIRED OR	0.11 ACFM	0.31 = % AIR (PRIMARY)
0.02	LB/MIN = SECONDARY COMBUSTION AIR REQUIRED OR	0.24 ACFM	0.69 = % AIR (SECONDARY)
0.03	LB/MIN = TOTAL COMBUSTION AIR REQUIRED OR	0.35 ACFM	1.00 = % AIR (TOTAL)

THERMAL OXIDIZER UNIT - COMBUSTION CALCULATIONS

5.E. COMBINED OUTLET STREAM - NATURAL GAS COMBUSTION ONLY

	LB/MIN	LBMOL/MIN	WEIGHT PERCENT	MOLE PERCENT	STP DENSITY POUND/CU.FT.	GAS FLOW SCFM	GAS FLOW, ACFM @ 1500.00 DEG F
OUTLET STREAM - STOICHIOMETRIC COMBUSTION MIXTURE PLUS SECONDARY AIR							
CARBON DIOXIDE	0.00	0.00	0.05	0.03	0.11	0.01	0.04
NITROGEN	0.02	0.00	0.75	0.76	0.07	0.28	1.03
OXYGEN	0.00	0.00	0.16	0.14	0.08	0.05	0.19
WATER	0.00	0.00	0.05	0.07	0.05	0.03	0.10
TOTALS	0.03	0.00	1.00	1.00		0.37	1.36

6. TOTAL OF COMBUSTION STREAMS FROM CLOSED VENT SYSTEM AND FROM NATURAL GAS

	LB/MIN	LBMOL/MIN	WEIGHT PERCENT	MOLE PERCENT	DENSITY @ STP, LB/FT^3	GAS FLOW SCFM	GAS FLOW, ACFM @ 1500.00 DEG F
COMBUSTION CHAMBER OUTLET STREAM - COMBUSTION GASES FROM BOTH STREAMS							
CARBON DIOXIDE	89.11	2.02	0.08	0.05	0.11	783.01	2896.98
NITROGEN	867.00	30.95	0.74	0.75	0.07	11968.09	44279.48
OXYGEN	174.76	5.46	0.15	0.13	0.08	2111.93	7813.69
WATER	9.93	0.55	0.01	0.01	0.05	213.18	788.73
H2O (Combust Prd)	37.74	2.09	0.03	0.05	0.05	810.00	2996.85
TOTALS	1178.53	41.08	1.00	1.00		15886.22	58775.73

7. COMBUSTION CHAMBER AND STACK CALCULATIONS

COMBUSTION CHAMBER GAS FLOWRATE =	15886.22	SCFM OR	58775.73	ACFM AT	1500.00	DEG F
COMBUSTION CHAMBER DIAMETER =	6.45	FEET				
COMBUSTION CHAMBER HEIGHT =	22.50	FEET				
COMBUSTION CHAMBER VOLUME =	734.70	CUBIC FEET				
COMBUSTION CHAMBER RESIDENCE TIME =	0.75	SECONDS				
COMBUSTION CHAMBER VELOCITY =	30.00	FEET/SECOND				
COMBUSTION CHAMBER CROSS SECTION AREA =	32.65	SQUARE/FT				
THEORETICAL BURNER CAPACITY =	0.00	MMBTU/HR				
DESIGN MAXIMUM BURNER CAPACITY =	5.00	MMBTU/HR				
ESTIMATED STACK DIAMETER =	6.75	FEET				
STACK VELOCITY =	27.37	FEET/SECOND				

EXAMPLE

Appendix D-VII
Attachment 2

Thermal Metal Wash
(TMW) System

Draft Trial Burn Test Report Outline

EXAMPLE
Thermal Metal Wash System
Draft Trial Burn Test Report Outline

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RCRA PART B APPLICATION

RINECO HAZARDOUS WASTE MANAGEMENT FACILITY
HASKELL, ARKANSAS

SECTION I

CLOSURE PLAN

REVISED: June 08, 2011

SECTION I

CLOSURE PLAN

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SECTION I

CLOSURE PLAN

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SECTION I

CLOSURE PLAN

I-0 INTRODUCTION

Rineco incorporates four container storage areas in Buildings 100, 200, 100/200 Corridor and 500, three disperser tanks in Building 100, twelve bulk storage tanks in Building 200, one collection tank in Building 400, four miscellaneous units in Building 100 and one miscellaneous unit in Building 400. Various other types of accompanying equipment are also identified throughout the part B application.

The closure plan has been developed for the purposes of conducting closure of the facility or closure of selected unit(s) according to applicable regulations at any time during the active life of the facility. However the closure plans are also developed and utilized as the basis for development of the closure cost estimates presented in Section J. Since the closure cost estimates are required to be based on third party implementation of closure, and some procedures prepared as such, the detailed procedures actually implemented by Rineco may vary. Regardless the applicable clean closure performance standards will be met upon closure.

I-1 WASTE CHARACTERIZATION

I-1a Maximum Waste Inventory / Regulated Unit Processes

The closure plans are prepared integral with the part B application that already includes in other sections the design plans, specifications and criteria for construction, operation, maintenance and management of the permitted container storage, tank storage and treatment and miscellaneous units (i.e., MTUs). Therefore some supporting information may be referenced and found elsewhere in the application. The hazardous waste management processes, locations and storage capacities proposed in this Part B application are as follows:

The designations, capacities and descriptions of the disperser tanks, bulk storage tanks and collection tanks are presented in Table I-A-1, I-A-2 and I-A-3 respectively, the container storage areas in Table I-A-4, and the miscellaneous units in Table I-A-5.

Since no additional storage quantities are associated with treatment of waste in tanks (TO1), containers (T04) and miscellaneous units (X02 & X03), there are no additional efforts or costs associated with closure of these permitted process activities.

I-1b Analysis of Wastes

The full range of hazardous waste types that may be managed at the Rineco facility are listed in the part A application form. Specification and characterization of liquid and solid waste materials are presented in the Waste Analysis Plan - Section C. Actual analytical records of incoming shipments are kept in the laboratory and can be used to document what wastes are actually onsite prior to initiating closure activities.

I-2 BACKGROUND SOIL ASSAYS AND GROUNDWATER QUALITY

I-2a Background Soil Samples

At the time of final closure of the permitted facility included in existing Building 100, Rineco will collect background samples for analysis of naturally occurring heavy metals in the soil as conditions dictate. Sampling will be performed in accordance with the procedures and schedules herein, and will be conducted in a manner such that documentation of clean closure for the facility has been met. Based on the designs of the facility that all unit operations are provided with secondary containment, and no evidence of soil contamination has been determined, soil sampling is not currently required by regulation. However, soil sampling efforts and the clean closure criteria associated with such is further discussed in Section I-3b-5 below.

I-2b Groundwater Quality

A groundwater monitoring program is not required for the facility to be permitted for operations under this part B application.

I-3 CLOSURE OF THE RINECO FACILITY

I-3a Notification of Intention to Close the Rineco Facility

The Director will be notified at least 45 days prior to the date Rineco intends to initiate final closure of the facility, in accordance with §264.112(d)(1). The notification of final closure will include the following information regarding timetables for implementation:

1) The date of planned closure;

2) Any proposed modifications to the closure plans, which will take advantage of new technology, unforeseen situations, or other changes which would improve the safety or efficiency of closure activities;

3) Revised schedule, if necessary, and updated estimated costs of implementation of the closure plan; and

4) Request for the release of closure funds in the amounts and times required by the closure schedule.

The notification, schedules and cost modifications will indicate activities compliant with the provisions of §264.112 through 264.115.

I-3b Implementation of Closure Plan

Rineco will inform the Director of the intention to close the facility by addressing the items listed in Section I-3a above. Rineco will then initiate the closure tasks after receiving any necessary approvals from the Director of modifications or revisions requested in the notice of closure. Partial closure of equipment or individual units will not require notification.

The following tasks are associated with the implementation of the clean closure plans for the facility:

1) Director approval of requested modifications to closure plan;

2) Preparation and mobilization of necessary equipment;

3) Removal of onsite bulk and containerized waste materials;

4) Decontamination of tank(s) and equipment;

5) Dismantling and removal of tank(s), equipment, and structural components;

6) Decontamination of secondary containment area(s);

7) Confirmation sampling and analysis;

8) Documentation of closure activities; and

9) Certification of clean closure.

Additional procedures for the removal of all containerized and bulk waste, the decontamination of all tank, process equipment, other structural components that may have been contaminated, and for the decontamination of secondary containment liners are presented in Appendix I-I. These procedures will be carried out to the extent necessary to certify clean closure of each unit utilized at the facility.

In the accomplishment of partial closure of any unit, that portion of the activities that will be implemented will be those required to meet the performance standards for defined partial or final closure. Partial closure activities that entail closure of individual units will be conducted in accordance with applicable closure plan procedures, with documentation of compliance of the partial closure activities presented in the final facility closure certification. Alternatively, individual partial closure certifications may be submitted to the Director on a case by case basis for approval of reduction of the financially assured closure cost estimates for the facility under permit. At any rate, the final activities required and compliance with performance criteria will be reported in the final facility closure certification. General coordination and implementation procedures follow below.

I-3b-1 Mobilization

Preparation of necessary facilities and mobilization of equipment not on site will be the first step in the closure process. Typical activities will include organization or construction of decontamination areas, mobilization of a crane or other heavy equipment and removal of any unnecessary equipment to offsite facilities.

I-3b-2 Removal of Bulk and Containerized Waste

Removal of stored wastes will began immediately following mobilization of equipment. Containerized wastes will be removed following an appropriate combination of the tasks listed in Appendix I-I Closure Procedures. Generally, all containerized waste will be identified using laboratory records or the Rineco bar code system. Containers will then be manifested to a licensed transporter in accordance with §263, loaded into trucks and shipped to an appropriate permitted hazardous waste management facility for treatment and disposal.

Tanks and process equipment will be pumped and drained empty, waste contained, manifested to transporters compliant with §263 and applicable Department of Transportation regulations, then shipped off-site by truck or railcar to a permitted hazardous waste management facility for treatment and disposal.

Decontamination of tanks and secondary containment areas will begin as soon as stored waste has been removed. All contaminated structures will be disposed of or decontaminated consistent with §264.114.

I-3b-3 Decontamination of Tanks, Equipment, Miscellaneous Units and Structural Components

Drained tanks, ancillary equipment, miscellaneous units and structural components will be cleaned as described below. The cleaning / decontamination waste residuals will be collected in containers, marked and manifests prepared for shipment to a permitted hazardous waste management facility.

After decontamination of each tank, miscellaneous unit, equipment item or structural component a wipe test or rinse water sample will be taken and analyzed to determine the success of the effort according to the criteria presented in Table I-B-1 (Clean Closure Criteria). Alternatively, should the various scrap metal and other recyclable materials recovered from the tanks, equipment, miscellaneous units, and other structures be determined to be difficult to decontaminate, they may be containerized for disposal offsite at a permitted hazardous waste facility. If viable for recycle, the materials may be cleaned as necessary, rather than decontaminated, and sold as scrap metal, reused, etc. Should analytical results indicate failure in meeting the closure criteria, again the dismantled materials may be sent to an appropriate disposal facility for final disposal, or cleaned as necessary for recycling or reuse, depending on the excessive costs of attempting additional decontamination effort.

In summary, Rineco will determine the feasibility of decontamination of units and components upon implementation of closure. Cursory sampling and analysis may be conducted on a case by case basis to assist in determining the most feasible course of action. For materials determined suitable for recycling or destined for disposal, clean-up to the extent necessary will be conducted prior to shipping, manifests or shipping papers prepared as necessary, and documentation of final destination / disposal prepared for closure certification. If it is determined that approval of any material decontamination activities at the facility is to be sought from ADEQ, sampling and analysis will be conducted in accordance with the applicable provisions listed in Table I-B-1.

I-3b-4 Decontamination of Secondary Containment Areas

Closure efforts and decisions regarding secondary containment area steel will follow the methods and criteria as in Section I-3b-3 above for tanks and other steel materials.

I-3b-5 Contaminated Soils and Related Media

The facility has been designed and managed consistent with applicable regulations to eliminate contamination of soil or groundwater by constructing secondary containment systems for all operations. Thus, it is not anticipated, nor is it required, that contingent closure planning be prepared in the case of unsuspected or unknown occurrence of contamination outside of the secondary containment structure. In either case, the following provisions are stated to provide actions that will ensure clean closure.

For verification, facility records will be reviewed during closure to determine the possibility of spills or releases to the environment that would be cause for concern during closure. In addition, if there is any potential indication of stained soils lending evidence that spillage or leakage may have occurred, sampling will be conducted for validation of contamination[1].

[1] If contamination is determined it may be excavated as necessary prior to sampling again. Alternatively, it may first be excavated to the extent that there is no apparent visible contamination and then sampled.

In either case, the following sampling procedure will be performed after removal of apparently affected soils, and/or upon final closure of the facility:

If existing background data is not determined satisfactory, background soil samples will be collected on unaffected property, preferably adjacent to the facility, to determine the naturally occurring heavy metal concentrations. Samples will be attained using soil core sampling techniques as described in I-3d-4, Soil Sampling Method below. Three samples will be acquired and analyzed as indicated in Table I-B-1. In the case of heavy metal constituents, the data from the three samples will be averaged and statistically compared to determine the background concentrations, unless available background data is adequate.

Samples will be gathered of the affected area (after any preliminary soil removal) and analyzed for constituents listed in Table I-B-1 to determine the existence and extent of any contamination. Random sampling of soil will be conducted for each area or unit being closed at a sample rate of 1 sample for every 10,000 square feet of the hazardous waste management unit being closed.

I-3b-6 Closure Certification

The closure project managing engineer will complete a Closure Quality Assurance Report based on personal oversight observation and field notes kept by the onsite engineer technician. This report will provide documentation of the closure activities and procedures completed in accordance with the approved closure plans. The certification will be signed by the owner or operator and by an independent Arkansas registered professional engineer using the appropriate regulatory certification language and transmitted to the Director.

I-3c Clean-up Criteria, Performance Standards and Quality Assurance

The closure plans are designed to insure the Rineco facility will be closed in a manner that will eliminate the need for further maintenance and control and eliminate threats to human health and the environment and prevent escape of any hazardous waste, hazardous waste constituents, contaminated run-off, or decontamination media to the ground, surface waters, or the atmosphere.

This activity can be performed utilizing a backhoe for loading dump trucks, or removed manually with shovels and accumulated in smaller containers, depending on what could be found. Containerized material will be managed according to allowable practice, and transported to a permitted hazardous waste management facility for treatment and disposal. Sampling will then be conducted again. Excavation equipment and other closure equipment (e.g., shovels) will be decontaminated in accordance with the related provisions of the closure plan. The excavation will be backfilled after all contaminated soils are removed and the site will be seeded with grass to prevent erosion.

The criteria for clean closure of tank surfaces and ancillary equipment, container and tank secondary containment surfaces and soil removal (if necessary) are summarized in Table I-B-1. These criteria are based on the long-term operating plans by Rineco to leave the site in an environmentally sound condition.

Ultimately, upon facility closure, the removal of all waste constituents to the extent defined as significant in Table I-B-1 will be verified based on relevant sample analysis, with the results presented in the closure certification report. Sampling will be conducted in accordance with applicable methodology for the media, either as stated herein or in accordance with best practices at time of closure. Sampling and analysis for determinations of clean closure certification will be conducted in strict accordance with applicable EPA methods and guidance by laboratories certified under the ADEQ laboratory certification program. All data and records generated during any closure activities will be assembled for review to ensure consistency with approved plans and applicable guidance. Sample sets will be validated as relevant to the area being closed and that all quality control samples meet laboratory standards for the method (see Table I-B-1). All deviations, including laboratory qualifiers, quality control deficiencies and an evaluation of the impact of each will be summarized in the closure certification report.

I-3d Sampling Procedures

Various procedures may be used for sampling to test for contamination. Examples of accepted sampling methodology are provided for the following matrices:

1) Liquid sampling method
2) Wipe test sampling method
3) Solid or sludge sampling method
4) Soil sampling method

I-3d-1 <u>Liquid Sampling Method</u>

1) Submerge a stainless steel dipper, coliwassa or other suitable device with minimal surface disturbance.

2) Allow the device to fill slowly and continuously.

3) Retrieve the dipper/device from the surface liquid with minimal disturbance.

4) Remove the cap from the sample bottle and slightly tilt the mouth of the bottle below the dipper/device edge.

5) Empty the dipper/device slowly, allowing the sample stream to flow

gently down the side of the bottle with minimal entry turbulence.

6) Continue delivery of the sample until the bottle is almost completely filled.

7) Check that a Teflon liner is present in the cap if required. Secure the cap tightly, leaving no air pockets.

8) Label the sample bottle with an appropriate sample tag. Be sure to label the tag carefully and clearly, addressing all the categories or parameters. Record the information in the field log book and complete the chain-of-custody form.

9) Place the properly labeled sample bottle in an appropriate carrying container maintained at a maximum temperature of 4°C throughout the sampling and transportation period.

10) Dismantle the sampler; wipe the parts with clean towels or rags and store them in plastic bags for subsequent cleaning. Store used towels or rags in garbage bags for subsequent disposal.

I-3d-2 <u>Wipe Test Sampling Method</u>

1) Saturate a clean sponge with distilled water.

2) Squeeze the water into a clean bottle, leaving no air pockets.

3) Place the properly labeled sample bottle in an appropriate carrying container maintained at a maximum temperature of 4°C throughout the transportation period. This will be the cross contamination sample for quality control.

4) Re-saturate the sponge with distilled water and manually scrub the inside of the tank, area of the process unit, along the bottom and walls. Secondary containment surfaces (steel or concrete) will be sampled similarly.

5) Squeeze the water into a clean bottle leaving no air pockets.

6) Place the properly labeled sample bottle in an appropriate carrying container maintained at a maximum temperature of 4°C throughout the transportation period.

I-3d-3 <u>Solid or Sludge Sampling Method</u>

1) Collect the desired quantity of solid material using a stainless steel scoop or trowel.

2) Transfer sample into an appropriate sample bottle with a stainless steel lab spoon or equivalent.

3) Check that a Teflon liner is present in the cap, if required. Secure the cap tightly.

4) Label the sample bottle with the appropriate sample tag. Fill out the label and the tag carefully and clearly, addressing all categories or parameters. Complete all chain-of-custody documents and record in the field log book.

Place the properly labeled sample bottle in an appropriate carrying container or ice chest maintained at a maximum temperature of 4°C throughout the sampling and transportation period.

I-3d-4 Soil Sampling Method

1) If necessary, a concrete corer will be used to remove the concrete slab over the proposed soil sampling location.

2) Remove the top layer of soil to the desired depth with a spade.

3) Collect the desired quantity of soil using a stainless steel scoop or trowel.

4) Transfer sample into an appropriate sample bottle with a stainless steel lab spoon or equivalent.

5) Check that a Teflon liner is present in the cap if required. Secure the cap tightly. Chemical preservation of solids is generally not recommended. Refrigeration is usually the best approach supplemented by minimal holding time.

6) Label the sample bottle with the appropriate sample tag. Fill out the label and the tag carefully and clearly, addressing all the categories or parameters. Complete all chain-of-custody documents and record in the field log book.

7) Place the properly labeled sample bottle in an appropriate carrying container or ice chest maintained at a maximum temperature of 4°C throughout the sampling and transportation period.

I-3d-5 Chain-of-Custody Procedures

A standardized chain-of-custody form will be utilized for the transmittal of all samples collected for verification of closure of the hazardous waste facilities defined in this part B application.

I-3e Schedule for Closure Activities

The expected year of final closure of all Rineco permitted operations is 30 years after part B permit issuance. Rineco will give notice to the Director at least 45 days prior to the date final closure of the facility is expected to begin. Closure will begin with inventory removal being completed within 90 days after receiving the final volume of hazardous waste. Thereafter, closure will proceed until completion within 180 days after receipt of final volume of hazardous waste. [§264.113] A lesser time may be required for closure dependent on the amount of waste in inventory. However, the closure plan schedule for closure activities is based on the maximum amount of waste in inventory. Within 60 days after completion of closure, certification of facility closure will be transmitted to the Director. Appendix I-II details the schedule of activities for closure of these process operations.

The schedule for closure of individual units is identical to the above schedules for facility closure, except that inapplicable activities would not be performed.

Appendix I-I

FACILITY CLOSURE PROCEDURES

I. GENERAL CLOSURE PROCEDURES

The container storage areas, disperser tank systems, bulk storage tank systems, collection tank systems and miscellaneous units are the hazardous waste management units to be closed in accordance with the procedures outlined in this appendix. These areas and units include the secondary containment, ancillary equipment and other various structures inherent to the design and operation of the facility. These procedures are developed as compliant with currently applicable regulations to enable development of the closure cost estimates presented in Section J. The procedures and estimates assume all activities will meet applicable regulatory requirements even if not stated as such.

II. REMOVAL OF CONTAINERS

The following description delineates the steps developed to completely remove all hazardous waste stored in containers.

1. Containers containing flammable liquids suitable for blended waste fuel will be positioned within the contained area of Building 200 adjacent to the truck loading area. The contents will then either be transferred to a vacuum truck using a flexible suction hose, or pumped directly into a tanker truck using a diaphragm pump and flexible suction hose. If a vacuum truck is used, the liquids may be transferred to a tanker truck for shipment. Shipment will then similarly proceed as in 4 below.

2. Containers containing pumpable sludge will be managed identically to flammable liquids. Shipment will then similarly proceed as in 4 below.

3. The removal of the remaining containerized solid waste will be accomplished by ensuring that all containers are properly packaged in the appropriate DOT approved containers, in good condition with no leaks or dents. Containers determined as in poor or unacceptable condition will be placed in an overpack, recovery drum, or otherwise repackaged using DOT specified containers. Shipment will then proceed as in 4 below.

4. Proper labeling will be applied as applicable according to EPA and DOT regulations, and manifest prepared for shipment. Containers will then be loaded as necessary for transport to the appropriate destination.

III. CLOSURE OF TANKS (BULK, DISPERSER & COLLECTION), MISCELLANEOUS UNITS (MTUs), ANCILLARY EQUIPMENT & SECONDARY CONTAINMENT STRUCTURES

Appendix I-I

A. General

The closure of bulk storage tanks and equipment is outlined in the following section. All tanks and associated equipment will be closed and decontaminated in a similar manner.

B. Decontamination and Closure Procedures

The bulk storage tanks fall into the following use categories: (1) storage of bulk waste liquids received for processing, (2) storage of blended fuel awaiting shipment, and (3) alternate tanks that may be used for either purpose (1 or 2). Disperser tanks are utilized solely for blending and conditioning of waste fuel prior to storage or shipment. Storage tanks are utilized for accumulation and blending prior to transfer to other processes.

In place clean closure of the tanks will be attempted prior to removal. Should difficulties be encountered, the sections and equipment may be cut into manageable size and 1) containerized or packaged for shipment to a hazardous waste facility, or 2) cleaned by available means as necessary and recycled as scrap metal, reused or sold. Alternatively the tanks may be removed as whole units, and transported according to hazardous waste transport and DOT regulations to another hazardous waste facility for final disposition. The procedures for decontamination and closure of bulk storage tanks are as follows:

1. All tanks will be closed in a similar manner. Each tank will be completely emptied of waste liquid (using existing pumps and piping) into tanker trucks. Any bottoms will be removed by opening a manway and inserting a flexible suction hose from either a vacuum truck or a diaphragm pump through the manway. The tank will then be isolated from all other tanks and from the pumping station by closing valves nearest the tank on all connected pipes.

2. The header, outlet piping and ancillary equipment to each bulk tank will then be cleaned within a secondary containment area, existing or fabricated.

3. Any contents of the vacuum truck will also be pumped into a tanker truck with common contents. The vacuum truck hose will be connected directly to the tanker truck for such transfers. This waste will then be transported by tanker truck to an offsite permitted hazardous waste facility for disposition.

4. The piping system is configured with gas connection fittings for the purpose of blowing them clear with inert gas. The venting system will be capped at the point where the tank is disconnected so that it will stay operable for the other tanks.

5. All piping will then be disconnected between the closed valves and the

tank. Ancillary equipment will be removed to the decontamination station for cleaning. Exposed tank and pipe openings will then be sealed using polyethylene sheeting or a comparable material. Drip pans and drip buckets will be used to catch any residual liquid that might drain from the system when the various piping connections are broken. Since the lines are blown clear prior to disconnection, only a minimal amount of liquid (<5 gallons) is expected to drain out. Liquids collected will be recovered by vacuum truck that is also used to remove the heel residual from the tanks. This liquid will also be transferred to a tanker truck for transport to an offsite permitted hazardous waste facility for disposition.

6. Each of the top-mounted agitators to the tanks will be disconnected from the drive units, removed from the tanks and relocated to the decontamination station for cleaning. The agitators will be manually decontaminated with a high pressure wash.

7. After the agitators have been cleaned, they will be spot rinsed and rinseate samples collected following methods described in Section I.3d of the closure plan. Analysis of samples will follow according to Table I-B-1 herein. If analysis reveals levels above clean closure criteria for any of the constituents listed, the decontamination procedures will be repeated until analysis of rinseate samples indicates the clean closure criteria has been met. Alternatively, the equipment may be 1) containerized and transported offsite to a permitted hazardous waste facility for final disposition, or 2) cleaned as required for recycling as scrap metal, reused, etc. All wash liquids will be collected for tanker truck transport to an offsite permitted hazardous waste facility for disposition.

8. After all pumpable residual liquids have been removed each tank will be cleaned in place using a high pressure wash. The procedures for collection of cleaning liquids for disposal, collection of rinseate samples and analysis will be consistent with procedures 6 and 7 above.

9. Following the same decontamination procedures as for agitators and tanks, all tanks system ancillary equipment, MTUs and MTU parts will then undergo decontamination, rinseate sampled and analyzed for closure determination and wash liquids collected for disposal.

10. Thereafter, disposal of secondary containment structures will follow consistent with the procedures discussed above.

Appendix I-II

Facility Closure Schedule

Item	Closure Task	Activity Timeline
1	Initiate facility closure	30 yrs after effective permit
2	Notify Director of closure	45 days prior to initiation of closure
3	Receipt of plan modification approval from Director (as necessary)	Prior to closure implementation
4	Final waste inventory received	Initiate closure activities
5	Removal of unnecessary facilities	Within 30 days of final waste receipt
6	Mobilization of equipment	Within 30 days of final waste receipt
7	Determine inventory of waste onsite by reviewing laboratory records & bar code database.	Within 30 days of final waste receipt
8	Label, manifest and load containers onto pallets; transport to off-site destination	Within 90 days of final waste receipt
9	Empty all tank systems into bulk tanker trucks; transport to off-site destination	Within 90 days of final waste receipt
10	Decontaminate tank systems	Within 45 days after final bulk waste removal
11	Sample tank systems to determine closure criteria compliance	1 week after tank decontamination completed
12	Repeat decontamination process (as necessary)	As necessary
13	Transport tanks & equipment to offsite destination	Within 45 days of bulk waste removal
14	Decontaminate steel plate secondary containment areas	Within 60 days of bulk/container waste removal
16	Remove wastewater to offsite destination	Within 1 week of generation
17	Demobilize equipment & personnel/ complete closure tasks	Within 180 days of final waste receipt

Table I-A-1
Building 100 - Disperser Tanks

Tank ID	Tank Capacity (Gallons)	Tank Dimensions (Diameter & Straight Side Wall)
T-108	2,200	7'6" × 7'6"
T-109	2,200	7'6" × 7'6"
T-110	2,200	7'6" × 7'6"
	Total Capacity = 6,600	

Table I-A-2
Building 200 - Bulk Storage Tanks

Tank ID	Tank Capacity (Gallons)	Tank Dimensions (Straight Side Wall)
T-201	29,400	14'0" × 26'0"
T-202	29,400	14'0" × 26'0"
T-203	29,400	14'0" × 26'0"
T-204	29,400	14'0" × 26'0"
T-205	29,400	14'0" × 26'0"
T-206	29,400	14'0" × 26'0"
T-207	29,400	14'0" × 26'0"
T-208	29,400	14'0" × 26'0"
T-209	29,400	14'0" × 26'0"
T-210	29,400	14'0" × 26'0"
T-211	29,400	14'0" × 26'0"
T-212	29,400	14'0" × 26'0"
	Total Capacity = 352,800	

Table I-A-3
Building 400 - Collection Tanks

Tank ID	Tank Capacity (Gallons)	Tank Dimensions (Straight Side Wall)
T-401	6,600	10'0" × 11'6"
	Total Capacity = 6,000	

Table I-A-4
Container Storage Area

Building	Maximum Permitted Storage Capacity - Each (gallon)	Dimensions of Curbed Floor (ft × ft)	Total Surface Area (ft^2)
100[1]	189,255	236 × 186 (Includes tank areas)	43,896
200[2]	990,000	225 × 345 + 28 × 25/2 + 25 × 12 + 25 × 12/2 (Inner Curbed Floor Area – includes tank area)	78,425
	NA	25 × 285 + 275 × 21 + 322 × 25 (Outer Curbed Floor Area for Conveyor Systems)	20,950
100/200 Corridor	9,020	121 × 35	4,235
500[2]	31,750	124 × 69	8,556
400	Tank T-401 Area Only	31 × 14.33 (Tank are only)	444

[1] Approximate area with a covered metal roof and having curbed concrete floor with .025 inch welded steel plate lining entire processing and storage areas.

[2] Approximate area with a covered metal roof and having curbed concrete floor with 0.25 inch welded steel plate lining entire building floor and sumps.

Table I-A-5
Miscellaneous Units (Shredders)*

Shredder ID	Approximate Dimensions (Overall)	Approximate Dimensions (Shredder Only)
M-103	20' X 12' X 23' tall	5' X 4' X 2.5'
M-104	20' X 12' X 23' tall	5' X 4' X 2.5'
M-105	20' X 12' X 23' tall	5' X 4' X 2.5'
M-106	20' X 12' X 23' tall	5' X 4' X 2.5'

Shredders have a square metal loading hopper attached on the top. Waste material is shredded through a row of metal plates w/ teeth. Shredded material exits the bottom of the shredder into totes.

* Note: Refer to Section J, Appendix J-III-G, TMW Table J-III-5 for TMW Equipment Surface Areas

Table I-B-1

Analytical Parameters & Methods and Clean Closure Criteria

Analysis [1]	Method [2]	"Clean Closure" Standard	
		Soils	Other [3]
Aromatic Volatile Organics	8020	<100 ppb	
Semi-Volatile Organics	8270		
Pesticides	608/608.2/8081	NA	<100 ppb
Pesticides [4]		Background	NA
Sulfates [5]	300.0	<100 ppb	
Sulfides [5]	376.1		
Cyanide (total) [5]	335.2		
Cyanide (reactive) [5]	335.1		
TCLP Metals [4]			
Arsenic	6010/5021	Background	<5.0 ppm
Barium	6010/7000B		<100.0 ppm
Cadmium	6010/7000B		<1.0 ppm
Chromium	6010/7000B		<5.0 ppm
Lead	6010/7000B		<0.2 ppm
Mercury	7470		<1.0 ppm
Selenium	6010/7010		<1.0 ppm
Silver	6010/7000B		<5.0 ppm

[1] For sample results generated for the purpose of demonstrating and documenting that clean closure has been accomplished in a given media, where applicable: duplicate samples will be collected on 5% of analysis; contamination will be monitored daily by using blank analysis; and spiked samples will be generated on 5% of the analysis.

[2] All methods from SW-846, "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," Third Edition.

[3] Includes Tanks, Piping, Pumps, Secondary Containment Concrete, Steel or Synthetic System from Wipe Test Analysis

[4] Extraction Method 1311

[5] Building 500 closure only

All analysis of samples to be utilized as documentation of the success of clean closure will be conducted by laboratories certified under the ADEQ laboratory certification program.

RCRA PART B APPLICATION

RINECO HAZARDOUS WASTE MANAGEMENT FACILITY
HASKELL, ARKANSAS

SECTION J

CLOSURE COST ESTIMATES &
FINANCIAL REQUIREMENTS

REVISED: June 08, 2011

APPENDIX J-III-D
SUMMARY OF TRANSPORT, DISPOSAL AND SITE CLOSURE COSTS

RINECO FACILITY-WIDE HAZARDOUS WASTE OPERATIONS

Item	Description		Cost
	From Appendix F-III-E-2 (Transport & Disposal Costs):		
	HAZARDOUS WASTE CONTAINER DISPOSAL COSTS		
H.	DESTRUCTIVE INCINERATION - CONTAINER DISPOSAL COST	=	$1,981,806.01
I.	ALTERNATIVE FUELS (BULK SLUDGE) - CONTAINER DISPOSAL COST	=	$929,354.59
J.	ALTERNATIVE FUELS - CONTAINER DISPOSAL COST	=	$110,054.67
	HAZARDOUS WASTE TANK DISPOSAL COSTS		
K.	ALTERNATIVE FUELS - TANK BLENDED LIQUIDS DISPOSAL UNIT COS	=	$93,135.90
L.	ALTERNATIVE FUELS - TANK SLUDGE DISPOSAL COST	=	$141,064.50
	OTHER OFF-SITE HAZARDOUS WASTE DISPOSAL		
M.	DECON WATER DISPOSAL COST	=	$550,105.71
N.	HAZARDOUS WASTE LANDFILL - CONTAINER DISPOSAL COST	=	$2,912.20
	TOTAL OFF-SITE CLOSURE COSTS	=	$3,808,433.58
	From Appendix F-III-D (On-Site Work Activities: Closure Cost Estimate Summary):		
	TOTAL ON-SITE CLOSURE COSTS	=	$983,863.68
	TOTAL CLOSURE COST ESTIMATE	=	$4,792,297.26

TRANSPORTATION UNIT COSTS

Item	Description		Unit Cost
A.	DESTRUCTIVE INCINERATION - CONTAINER TRANSPORTATION UNIT COST		
1	Container Truck capacity (# of 55-gal containers per load)	80	
2	One-way distance (miles per load)	x[1]	
3	Transportation unit cost ($ per mile)	y[2]	
4	Transportation unit cost ($ per container)	(A.2 x A.3 / A.1) =	20.322
B.	ALTERNATIVE FUELS (BULK SLUDGE) - CONTAINER TRANSPORTATION UNIT COST		
1	Container Truck capacity (# of 55-gal containers per load)	70	
2	One-way distance (miles per load)	x[1]	
3	Transportation unit cost ($ per mile)	y[2]	
4	Transportation unit cost ($ per container)	(B.2 x B.3 / B.1) =	23.225
C.	ALTERNATIVE FUELS - CONTAINER TRANSPORTATION UNIT COST[3]		
1	Container Truck capacity (# of 55-gal containers per load)	79	
2	One-way distance (miles per load)	x[1]	
3	Transportation unit cost ($ per mile)	y[2]	
4	Transportation unit cost ($ per container)	(C.2 x C.3 / C.1) =	8.395
D.	ALTERNATIVE FUELS - TANK TRUCK TRANSPORTATION UNIT COST		
1	Tank Truck capacity (gallon/load)	5,000	
2	One-way distance (miles per load)	x[1]	
3	Transportation unit cost ($ per mile)	y[2]	
4	Transportation unit cost per gallon ($ per gallon)	(D.2 x D.3 / D.1) =	0.218
E.	DESTRUCTIVE INCINERATION - TANK TRUCK TRANSPORTATION UNIT COST		
1	Tank Truck capacity (gallon/load)	5,000	
2	One-way distance (miles per load)	x[1]	
3	Transportation unit cost ($ per mile)	y[2]	
4	Transportation unit cost per gallon ($ per gallon)	(E.2 x E.3 / E.1) =	0.320
F.	DECONTAMINATION WATER TREATMENT - RAILCAR TRANSPORTATION UNIT COST		
1	Railcar capacity (gallon/load)	20,000	
2	One-way distance (miles per load)	x[1]	
3	Transportation unit cost ($ per mile)	y[2]	
4	Transportation unit cost per gallon ($ per gallon)	(F.2 x F.3 / F.1) =	0.142
G.	HAZARDOUS WASTE LANDFILL - CONTAINER TRANSPORTATION UNIT COST[4]		
1	Container Truck capacity (# of 55-gal containers per load)	4	
2	One-way distance (miles per load)	x[1]	
3	Transportation unit cost ($ per mile)	y[2]	
4	Transportation unit cost ($ per container)	(G.2 x G.3 / G.1) =	661.500

NOTES:

1. "x" represent the variable mileage to the required disposal facility.
2. "y" represents the corresponding variable unit transportation cost per mile for the particular waste disposal type & required disposal facility.
3. Waste transported in 5-gallon pails @ 864 pails per load, converted to equivalent 55-gallon capacity loads for alternative fuels disposal.
4. TMW demolition waste (insulation, gaskets, etc.) transported in 55-gallon drums @ 4 drums per load; total estimate for disposal = 1 ton.

APPENDIX J-III-E
OFF-SITE CLOSURE COSTS

TRANSPORTATION & DISPOSAL COSTS

Item	Description		Total Costs
	HAZARDOUS WASTE CONTAINER DISPOSAL COSTS		
H.	DESTRUCTIVE INCINERATION - CONTAINER DISPOSAL COST		
1	Total number of full containers	7,339	
2	Container capacity (gallon per container)	55	
3	Unit cost for disposal ($ per gallon)	4.54	
4	Unit cost for disposal ($ per container)	(H.2 X H.3) =	249.70
5	Total Transport & Disposal cost	[H.1 x (H.4+A.4)] =	**$1,981,806.01**
I.	ALTERNATIVE FUELS (BULK SLUDGE) - CONTAINER DISPOSAL COST		
1	Total number of full containers (drums)	7,339	
2	Container capacity (gallon per container)	55	
3	Unit cost for disposal ($ per gallon)	1.88	
4	Unit cost for disposal ($ per container)	(I.2 X I.3) =	103.40
5	Total Transport & Disposal cost	[I.1 x (I.4 + B.4)] =	**$929,354.59**
J.	ALTERNATIVE FUELS - CONTAINER DISPOSAL COST		
1	Total number of full containers (drums)	7,339	
2	Container capacity (gallon per container)	55	
3	Unit cost for disposal ($ per gallon)	0.12	
4	Unit cost for disposal ($ per container)	(J.2 X J.3) =	6.60
5	Total Transport & Disposal cost	[J.1 x (J.4 + C.4)] =	**$110,054.67**
	HAZARDOUS WASTE TANK DISPOSAL COSTS		
K.	ALTERNATIVE FUELS - TANK TRUCK WASTE DISPOSAL UNIT COST		
1	Total blended liquids disposal quantity (gallon)	275,550	
2	Unit cost for disposal ($ per gallon)	0.12	
4	Total Transport & Disposal cost	[K.1 x (K.2 + D.4)] =	**$93,135.90**
L.	DESTRUCTIVE INCINERATION - TANK TRUCK WASTE DISPOSAL UNIT COST		
1	Total sludge disposal quantity (gallon)	89,850	
2	Unit cost for disposal ($ per gallon)	1.25	
3	Total Transport & Disposal cost	[L.1 X (L.2 + E.4)] =	**$141,064.50**
	OTHER OFF-SITE HAZARDOUS WASTE DISPOSAL		
M.	DECON WATER DISPOSAL UNIT COST[5]		
1	Total rinse water disposal quantity (gallon)	929,233	
2	Off-site disposal unit cost ($ per gallon)	0.45	
3	Total Transport & Disposal cost	[M.1 x (M.2 + F.4)] =	**$550,105.71**
N.	HAZARDOUS WASTE LANDFILL - CONTAINER DISPOSAL COST		
1	Total number of full containers (drums)	4	
2	Container capacity (gallon per container)	55	
3	Unit cost for disposal ($ per gallon)	1.21	
4	Unit cost for disposal ($ per container)	(I.2 X I.3) =	66.55
5	Total Transport & Disposal cost	[N.1 x (N.4 + G.4)] =	**$2,912.20**

NOTES (Continued):

5. Total Decontamination Water attributable to the Thermal Metal Wash (TMW) Unit = 156,228 gallons, at a total transportation and disposal cost of $92,487.13.

APPENDIX J-III-F
ON-SITE CLOSURE ACTIVITIES: COST ESTIMATE SUMMARY

CONTAINERS	%	# OF 55 GALLON CONTAINERS	COST PER DRUM ($)	COSTS ($)
Fuels	33.33%	7,339	22.29	163,596
Fuels (Bulk Sludge)	33.33%	7,339	19.60	143,853
Destructive Incineration (Containers)	33.33%	7,339	12.19	89,480
SUBTOTAL CONTAINERS	100%	22,018		396,929
TANKS	%	GALLONS	COST PER GALLON ($)	COSTS ($)
Fuels	75%	275,550	0.14	37,766
Fuels (Sludge)	25%	89,850	0.08	6,986
SUBTOTAL TANKS				44,753
DECONTAMINATION OF CONTAINER, TANK STORAGE & PROCESS EQUIPMENT CONTAINMENT AREAS ($)[1]				98,286
DECONTAMINATION OF TANKS AND ANCILLARY EQUIPMENT ($)[1]				78,214
DECONTAMINATION OF PROCESS EQUIPMENT (NON-TMW) ($)				13,213
DISMANTLING OF EQUIPMENT (NON-TMW) ($)				191,151
CERTIFICATION OF FINAL CLOSURE (NON-TMW) ($)				41,647
DECONTAMINATION OF TMW CONTAINMENT AREA ($)				5,942
TMW EQUIPMENT DECONTAMINATION ($)				50,496
DISMANTLING OF TMW EQUIPMENT ($)				54,011
CERTIFICATION OF TMW UNIT CLOSURE ($)				9,223
TOTAL ON-SITE CLOSURE COST ESTIMATE				983,864

[1] Includes Collection Tank T-401, Ancillary Equipment & Containment Area; TMW Heat Exchangers Included in TMW Equipment Closure Costs

APPPENDIX J-III-H
(Thermal Metal Wash System Only)

WORKSHEET TMW-1

DECONTAMINATION OF TMW CONTAINMENT AREA

Protective clothing and safety equipment for facility personnel		
# of personnel requiring PPE*	5	
Personnel protective clothing unit cost ($/person)	95.09	
Safety equipment and protective clothing cost ($)		475.45
*PPE - Personnel protective equipment		
Containment Area Decontamination		
Includes Secondary Containment Steel by Steam Cleaning		
Building 400 (105' x 104') - (63*19) - (14.33*31)	9,279	
Total Pad Area (SF)	9,279	
(NOTE: See Appendix J-III-G, Worksheet A-4 for Closure of Tank T-401 & Tank Containment Area)		
Equipment rental unit cost ($/hr)	4.26	
Equipment unit operating cost ($/hr)	0.99	
Unit labor cost ($/hr)	25.00	
Pad decontamination cleaning rate (ft2/hr)	75.00	
Number of hours to clean pads (hrs)	124	
Unit cost per hour to clean pad ($/hr)	30.24	
Total labor and equipment to decontaminate pads ($)		3,741.54
Residual generation rate (gal/ft2)	4	
Total residual generated (gal)	37,116	
Testing for success of decontamination		
Number of samples required	2	
Sample collection time (hrs/sample)	0.5	
Sampling technician unit labor cost ($/hr)	25.00	
Sample collection time (hrs)	1.0	
Sampling cost ($)	25.00	
Unit cost of analysis ($/sample)	850.00	
Total cost of testing for success of decontamination ($)		1,725.00
TOTAL COST OF DECONTAMINATION OF TMW CONTAINMENT AREA ($)		5,941.99

APPPENDIX J-III-H
(Thermal Metal Wash System Only)

WORKSHEET TMW-2

DECONTAMINATION OF TMW EQUIPMENT

Protective clothing and safety equipment for facility personnel		
# of personnel requiring PPE*	4	
Personnel protective clothing unit cost ($/person)	95.09	
Safety equipment and protective clothing cost ($)		380.36
*PPE - Personnel protective equipment		
Equipment Decontamination:		
Includes Piping & Equipment (Valves, Pumps Feed lines & Filters)		
Piping & Ancillary Equipment Decontamination		
Number of pumps & filters	13	
Total number of feet of feed lines - 12" (ft)	50	
Total number of feet of feed lines - 8" (ft)	40	
Total number of feet of feed lines - 6" (ft)	200	
Total number of feet of feed lines - 4" (ft)	20	
Total number of feet of feed lines - 3" (ft)	1,670	
Total number of feet of feed lines - 2" (ft)	0	
Total number of feet of feed lines 1" (ft)	506	
# of hours to flush lines (4 hrs/50 ft) (hrs)	199	
# of hours to decontaminate pumps & filters (4 hrs/pump)	52	
Total hours to decontaminate pumps, filters & lines (hrs)	251	
Total labor cost @ $25.00/hr	6,272.00	
# of bags of caustic for line decon. (1 bag/200 gal)	27	
Cost of caustic @ $33.28/bag	888.07	
Cost of fresh rinse water ($1.45/1000 gal)	7.74	
Total for line & pump decontamination ($)		7,167.81
Residual generated from 12" line and pump cleaning (gal)	1,188	
Residual generated from 8" line and pump cleaning (gal)	422	
Residual generated from 6" line and pump cleaning (gal)	1,188	
Residual generated from 4" line and pump cleaning (gal)	53	
Residual generated from 3" line and pump cleaning (gal)	2,405	
Residual generated from 2" line and pump cleaning (gal)	0	
Residual generated from 1" line and pump cleaning (gal)	81	
Total residual generated - line and pump cleaning (gal)	5,337	
TMW Equipment Decontamination		
# of people entering tanks	4	
Additional PPE unit cost ($/person)	205.00	
Additional safety equipment cost ($)	820.00	
Method of decontamination - steam cleaning		
Equipment surface area to be decontaminated (ft2)	28,444	
Equipment rental cost ($/hr)	4.255	
Equipment operating cost ($/hr)	0.9866	
Unit labor cost ($/hr)	25.00	
Cleaning rate (ft2/hr)	50	
# of hours to clean equipment	569	
Unit cost to clean equipment ($/hr)	30.24	
Total labor and equipment cost ($)	18,023.74	
Surcharge factor (2.0)	2	
Total TMW equipment decontamination cost ($)		36,047.47
Residual generation rate (gal/ft2)	4	
Total residual generated from equipment cleaning (gal)	113,775	
Off-site Treatment of Decontamination Residual		
Total volume of residual generated (gal)	119,112	

APPPENDIX J-III-H
(Thermal Metal Wash System Only)

Testing for Success of Decontamination		
Number of samples required	8	
Sample collection time (hrs/sample)	0.5	
Sampling technician unit labor cost ($/hr)	25.00	
Sample collection time (hrs)	4	
Sampling cost ($)	100.00	
Unit cost of analysis ($/sample)	850.00	
Total cost of testing for success of decontamination ($)		6,900.00
TOTAL TMW EQUIPMENT DECONTAMINATION COST ($)		50,495.64

APPPENDIX J-III-H
(Thermal Metal Wash System Only)

WORKSHEET TMW-3

REMOVAL OF TMW PROCESS & ANCILLARY EQUIPMENT & FLOOR PLATES

Equipment Dismantling:
Includes Piping, Process Equipment & Steel Secondary Containment

Process equipment - ft2 to be cut	28,444	
Number of ft2/hr (5' x 5' sheets)	18.75	
# of hours to cut process equipment (hrs)	1,517	
Unit labor cost ($/hr)	25.00	
Weeks to complete process equipment dismantling (wks)	3.0	
Boom lift rental (2) ($1783/mo)	3566.00	
Forklift rental (2) ($595/mo)	1190.00	
Cutting torches rental ($/hr)	0.02734	
Total for process equipment dismantling ($)		42,722.58
Floor steel plate - ft2 to be cut	9,279	
Number of ft2/hr (5' x 5' sheets) (hrs)	31.25	
# of hours to cut floor plates (hrs)	297	
Unit labor cost ($/hr)	25.00	
Weeks to complete floor plate dismantling (wks)	2	
Forklift rental (2) ($595/mo)	1190.00	
Cutting torches rental ($/hr)	0.02734	
Total for floor plate dismantling ($)		8,621.32
Ancillary equipment to be dismantled - ft to be cut	2,486	
Number of ft/hours (5' sections) (hrs)	30	
# of hours to cut pipes (hrs)	83	
Unit labor cost ($/hr)	25.00	
Weeks to complete ancillary equipment dismantling (wks)	2.8	
Total for ancillary equipment dismantling ($)		2,071.67
Scrap metal removal ($) credit not allowed	0.00	
Mobilization of rental equipment	595.00	
Total mobilization and removal of scrap metal ($)		595.00
TOTAL COST FOR DISMANTLING OF EQUIPMENT ($)		54,010.56

APPPENDIX J-III-H
(Thermal Metal Wash System Only)

WORKSHEET TMW-4

CERTIFICATION FOR TMW UNIT CLOSURE

Independent Registered Professional Engineer		
Initial review of closure plan (hrs)	6	
Inspection frequency (Inspections/week)	1	
Inspection time required (hrs/inspection)	4	
# of weeks for closure	8	
Inspection time required (hrs)	38	
Preparation of final closure document (hrs)	24	
Total professional engineer time required (hrs)	62	
Professional engineer unit labor cost ($/hr)	110.00	
Professional engineer cost ($)		6,820.00
Soil Testing for Verification of Clean Closure		
Number of samples required	2	
Sample collection time (hrs/sample)	0.5	
Sampling technician unit labor cost ($/hr)	25.00	
Sample collection time (hrs)	1.0	
Sampling cost ($)	25.00	
Unit cost of analysis ($/sample)	1,189.00	
Total cost of soil testing for verification ($)		2,403.00
TOTAL COST FOR CERTIFICATION OF CLOSURE ($)		9,223.00

APPENDIX J-III-H
TMW Table J-III-5
TMW Equipment Surface Area

Item No.	Equipment Description	Component	Exterior Surface Area (sq ft)	Interior Surface Area (sq ft)	Misc Surface Factor 15% (sq ft)	Unit Area (sq ft)	Total Area (sq ft)
1	Feed Hopper	Hood	224	224	67	515	
		Hood Steel Support	700	0	105	805	**1,320**
2	Feed Screws	4 Screw Live Bottom	240	390	95	725	
		1 Transfer Screw	72	136	31	239	**964**
3	Hot Oil Screw	Trough	646	646	194	1,485	
		Screws	377	283	99	759	
		Hoods	185	185	56	426	
		Stand/Support	306	0	46	352	**3,021**
4	Electric Heat Screw	Trough	446	446	134	1,025	
		Screws	251	188	66	506	
		Hoods	62	62	19	142	
		Stand/Support	164	0	25	189	**1,861**
5	Cooling Screw 1	Trough/Cover	224	224	67	515	
		Screw	203	70	41	315	
		Hood/Transition	28	28	8	64	
		Stand/Support	164	0	25	189	**1,083**
6	Cooling Screw 2	Trough/Cover	224	224	67	515	
		Screw	203	70	41	315	
		Divert Gate/Trans	102	102	31	235	
		Stand/Support	164	0	25	189	**1,253**
7	Drag Conveyor 1	Top Trough	174	174	52	399	
		Boot Casing	116	116	35	266	
		Head Casing	74	74	22	169	
		Return Trough	174	174	52	399	
		Chain	440	0	66	506	
		Supports	160	0	24	184	
		Hood/Transition	28	28	8	64	**1,988**
8	Deck Screen	Top Cover	41	41	12	93	
		Sides	143	143	43	328	
		Decks	81	81	24	186	
		Hood/Transition	28	28	8	64	**672**
9	Char Conveyor 1	Transition Hood	26	26	8	60	
		Top Enclosed Hood	110	110	33	253	
		Bottom Hood	110	110	33	253	
		Conveyor	78	0	12	90	
		Conveyor Components	400	0	60	460	
		Char Magnet	340	680	153	1,173	
		Discharge Chutes	96	96	29	221	
		Support Steel	164	0	25	189	**2,698**
10	Char Conveyor 2	Transition Hood	26	26	8	60	
		Top Enclosed Hood	110	110	33	253	
		Bottom Hood	110	110	33	253	
		Conveyor	78	0	12	90	
		Conveyor Components	400	0	60	460	
		Overs Magnet	548	1,096	247	1,891	
		Discharge Chutes	144	144	43	331	
		Support Steel	225	0	34	259	**3,597**
11	Drag Conveyor 2	Top Trough	174	174	52	399	
		Boot Casing	116	116	35	266	
		Head Casing	74	74	22	169	
		Return Trough	174	174	52	399	
		Chain	440	0	66	506	
		Supports	160	0	24	184	
		Hood/Transition	28	28	8	64	**1,988**
12	Venturi 1	Venturi	20	20	6	45	
		Inlet	25	25	8	58	
		Reservoir	64	64	19	147	**250**
13	Venturi 2	Venturi	20	20	6	45	
		Inlet	25	25	8	58	
		Reservoir	64	64	19	147	**250**

APPENDIX J-III-H
TMW Table J-III-5
TMW Equipment Surface Area

Item No.	Equipment Description	Component	Exterior Surface Area (sq ft)	Interior Surface Area (sq ft)	Misc Surface Factor 15% (sq ft)	Unit Area (sq ft)	Total Area (sq ft)
14	Venturi 3	Venturi	20	20	6	45	
		Inlet	25	25	8	58	
		Reservoir	48	48	14	110	**213**
15	Venturi 4	Venturi	20	20	6	45	
		Inlet	25	25	8	58	
		Reservoir	64	64	19	147	**250**
16	Venturi 5	Venturi	20	20	6	45	
		Inlet	25	25	8	58	
		Reservoir	48	48	14	110	
		Cyclone	30	30	9	69	**282**
17	Venturi 6	Venturi	20	20	6	45	
		Inlet	25	25	8	58	
		Reservoir	54	54	16	124	
		Cyclone	30	30	9	69	
		Demister	104	104	31	238	**534**
18	Heat Exchanger 1	External (no plates)	126	0	19	145	
		Internals (plates)		342	51	393	**538**
19	Heat Exchanger 2	External (no plates)	126	0	19	145	
		Internals (plates)		342	51	393	**538**
20	Heat Exchanger 3	External (no plates)	126	0	19	145	
		Internals (plates)		342	51	393	**538**
21	Heat Exchanger 4	External (no plates)	126	0	19	145	
		Internals (plates)		342	51	393	**538**
22	Heat Exchanger 5	External (no plates)	126	0	19	145	
		Internals (plates)		342	51	393	**538**
23	Heat Exchanger 6	External (no plates)	126	0	19	145	
		Internals (plates)		342	51	393	**538**
24	Heat Exchanger 7	External (no plates)	126	0	19	145	
		Internals (plates)		342	51	393	**538**
25	Wet Dust Collector	Wet Dust Collector	176	192	55	423	
		Internals (plates)	21	21	6	49	**472**
26	TOU-102	Internal Wall (Cylinder)	NA	748	NA	748	
		Interior Bottom		38	NA	38	786
27	TOU-103	Internal Wall (Cylinder)	NA	1,131	NA	1,131	
		Interior Bottom		64	NA	64	1,195
				Total TMW Equipment Surface Area =			28,444

APPENDIX J-III-G

Table J-III-6

TMW Pipe Length Flushing Calculations

Item No.	Description	Component	Diameter (in)	Length (ft)	Total Lineal Feet by Pipe Dia.						
			Pipe Diameter =		12	8	6	4	3	2	1
1	Piping at V1	Vent Piping to V6 Header	8	12		12					
		Spray Piping Into V1	3	95					95		
		Discharge Piping to Pump & H/X	3	120					120		
			1	30							30
		Misc Pipe Fittings (Strainers, etc.)									
2	Piping at V2	Vent Piping to V6 Header	8	12		12					
		Spray Piping Into V2	3	110					110		
		Discharge Piping to Pump & H/X	3	136					136		
			1	30							30
		Misc Pipe Fittings (Strainers, etc.)									
3	Piping at V3	Vent Piping to V6 Header	8	8		8					
		Spray Piping Into V3	3	124					124		
		Discharge Piping to Pump & H/X	3	150					150		
			1	30							30
		Misc Pipe Fittings (Strainers, etc.)									
4	Piping at V4	Vent Piping to V6 Header	8	8		8					
		Spray Piping Into V4	3	136					136		
		Makeup Liquid Piping	1	84							84
		Discharge Piping to Pump & H/X	3	164					164		
			1	30							30
		Misc Pipe Fittings (Strainers, etc.)									
5	Piping at V5	Vent Piping to Blower/TOU Header	3	32					32		
			6	200			200				
		Vent Piping from Wet Dust Collector	3	54					54		
		Spray Piping Into V7	3	32					32		
		Makeup Liquid Piping	1	24							24
		Discharge Piping to Pump & H/X	1	124							124
		Spray piping into Cooling Screw 1	1	124							124
		Misc Pipe Fittings (Strainers, etc.)									
6	Piping at V6	Vent Piping to Tou Header	3	200					200		
		Vent Piping from V1-V4	12	50	50						
		Spray Piping Into V6	3	95					95		
		Discharge Piping to Pump & H/X	3	120					120		
			1	30							30
		Misc Pipe Fittings (Strainers, etc.)									

APPENDIX J-III-G

Table J-III-6

TMW Pipe Length Flushing Calculations

Item No.	Description	Component	Diameter (in)	Length (ft)	Total Lineal Feet by Pipe Dia.						
			Pipe Diameter =		12	8	6	4	3	2	1
7	Piping at Wet Dust Collector	Vent Piping from Magnets	3	90					90		
		Vent Piping from Conveyor	3	12					12		
		Discharge Piping to Char Conveyor	4	20				20			

	12	8	6	4	3	2	1
Total TMW Piping Lengths per Diameter =	50	40	200	20	1670	0	506
Pipe Diameter	12	8	6	4	3	2	1
Pipe X-Section Area	113.1	50.265	28.274	12.566	7.0686	3.1416	0.7854
Gallons per Flush	297	132	74.25	33	18	8	2
# of Flushes	4	4	4	4	4	4	4
Gallons per 50' of Pipeline	1188	528	297	132	72	32	8

Table I-B-1

Analytical Parameters & Methods and Clean Closure Criteria

Analysis [1]	Method [2]	"Clean Closure" Standard	
		Soils	Other [3]
Aromatic Volatile Organics	8020	<100 ppb	
Semi-Volatile Organics	8270		
Pesticides	608/608.2/8081	NA	<100 ppb
Pesticides [4]		Background	NA
Sulfates [5]	300.0	<100 ppb	
Sulfides [5]	376.1		
Cyanide (total) [5]	335.2		
Cyanide (reactive) [5]	335.1		
TCLP Metals [4]			
Arsenic	6010/5021	Background	<5.0 ppm
Barium	6010/7000B		<100.0 ppm
Cadmium	6010/7000B		<1.0 ppm
Chromium	6010/7000B		<5.0 ppm
Lead	6010/7000B		<0.2 ppm
Mercury	7470		<1.0 ppm
Selenium	6010/7010		<1.0 ppm
Silver	6010/7000B		<5.0 ppm

[1] For sample results generated for the purpose of demonstrating and documenting that clean closure has been accomplished in a given media, where applicable: duplicate samples will be collected on 5% of analysis; contamination will be monitored daily by using blank analysis; and spiked samples will be generated on 5% of the analysis.

[2] All methods from SW-846, "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," Third Edition.

[3] Includes Tanks, Piping, Pumps, Secondary Containment Concrete, Steel or Synthetic System from Wipe Test Analysis

[4] Extraction Method 1311

[5] Building 500 closure only

All analysis of samples to be utilized as documentation of the success of clean closure will be conducted by laboratories certified under the ADEQ laboratory certification program.

RCRA PART B APPLICATION

RINECO HAZARDOUS WASTE MANAGEMENT FACILITY
HASKELL, ARKANSAS

SECTION J

CLOSURE COST ESTIMATES & FINANCIAL REQUIREMENTS

REVISED: June 08, 2011

APPENDIX J-III-D

SUMMARY OF TRANSPORT, DISPOSAL AND SITE CLOSURE COSTS

RINECO FACILITY-WIDE HAZARDOUS WASTE OPERATIONS

Item	Description		Cost
	From Appendix F-III-E-2 (Transport & Disposal Costs):		
	HAZARDOUS WASTE CONTAINER DISPOSAL COSTS		
H.	DESTRUCTIVE INCINERATION - CONTAINER DISPOSAL COST	=	$1,981,806.01
I.	ALTERNATIVE FUELS (BULK SLUDGE) - CONTAINER DISPOSAL COST	=	$929,354.59
J.	ALTERNATIVE FUELS - CONTAINER DISPOSAL COST	=	$110,054.67
	HAZARDOUS WASTE TANK DISPOSAL COSTS		
K.	ALTERNATIVE FUELS - TANK BLENDED LIQUIDS DISPOSAL UNIT COS	=	$93,135.90
L.	ALTERNATIVE FUELS - TANK SLUDGE DISPOSAL COST	=	$141,064.50
	OTHER OFF-SITE HAZARDOUS WASTE DISPOSAL		
M.	DECON WATER DISPOSAL COST	=	$550,105.71
N.	HAZARDOUS WASTE LANDFILL - CONTAINER DISPOSAL COST	=	$2,912.20
	TOTAL OFF-SITE CLOSURE COSTS	=	$3,808,433.58
	From Appendix F-III-D (On-Site Work Activities: Closure Cost Estimate Summary):		
	TOTAL ON-SITE CLOSURE COSTS	=	$983,863.68
	TOTAL CLOSURE COST ESTIMATE	=	$4,792,297.26

TRANSPORTATION UNIT COSTS

Item	Description		Unit Cost
A.	DESTRUCTIVE INCINERATION - CONTAINER TRANSPORTATION UNIT COST		
1	Container Truck capacity (# of 55-gal containers per load)	80	
2	One-way distance (miles per load)	x[1]	
3	Transportation unit cost ($ per mile)	y[2]	
4	Transportation unit cost ($ per container)	(A.2 x A.3 / A.1) =	20.322
B.	ALTERNATIVE FUELS (BULK SLUDGE) - CONTAINER TRANSPORTATION UNIT COST		
1	Container Truck capacity (# of 55-gal containers per load)	70	
2	One-way distance (miles per load)	x[1]	
3	Transportation unit cost ($ per mile)	y[2]	
4	Transportation unit cost ($ per container)	(B.2 x B.3 / B.1) =	23.225
C.	ALTERNATIVE FUELS - CONTAINER TRANSPORTATION UNIT COST[3]		
1	Container Truck capacity (# of 55-gal containers per load)	79	
2	One-way distance (miles per load)	x[1]	
3	Transportation unit cost ($ per mile)	y[2]	
4	Transportation unit cost ($ per container)	(C.2 x C.3 / C.1) =	8.395
D.	ALTERNATIVE FUELS - TANK TRUCK TRANSPORTATION UNIT COST		
1	Tank Truck capacity (gallon/load)	5,000	
2	One-way distance (miles per load)	x[1]	
3	Transportation unit cost ($ per mile)	y[2]	
4	Transportation unit cost per gallon ($ per gallon)	(D.2 x D.3 / D.1) =	0.218
E.	DESTRUCTIVE INCINERATION - TANK TRUCK TRANSPORTATION UNIT COST		
1	Tank Truck capacity (gallon/load)	5,000	
2	One-way distance (miles per load)	x[1]	
3	Transportation unit cost ($ per mile)	y[2]	
4	Transportation unit cost per gallon ($ per gallon)	(E.2 x E.3 / E.1) =	0.320
F.	DECONTAMINATION WATER TREATMENT - RAILCAR TRANSPORTATION UNIT COST		
1	Railcar capacity (gallon/load)	20,000	
2	One-way distance (miles per load)	x[1]	
3	Transportation unit cost ($ per mile)	y[2]	
4	Transportation unit cost per gallon ($ per gallon)	(F.2 x F.3 / F.1) =	0.142
G.	HAZARDOUS WASTE LANDFILL - CONTAINER TRANSPORTATION UNIT COST[4]		
1	Container Truck capacity (# of 55-gal containers per load)	4	
2	One-way distance (miles per load)	x[1]	
3	Transportation unit cost ($ per mile)	y[2]	
4	Transportation unit cost ($ per container)	(G.2 x G.3 / G.1) =	661.500

NOTES:

1. "x" represent the variable mileage to the required disposal facility.
2. "y" represents the corresponding variable unit transportation cost per mile for the particular waste disposal type & required disposal facility.
3. Waste transported in 5-gallon pails @ 864 pails per load, converted to equivalent 55-gallon capacity loads for alternative fuels disposal.
4. TMW demolition waste (insulation, gaskets, etc.) transported in 55-gallon drums @ 4 drums per load; total estimate for disposal = 1 ton.

APPENDIX J-III-E
OFF-SITE CLOSURE COSTS

TRANSPORTATION & DISPOSAL COSTS

Item	Description		Total Costs
HAZARDOUS WASTE CONTAINER DISPOSAL COSTS			
H.	DESTRUCTIVE INCINERATION - CONTAINER DISPOSAL COST		
1	Total number of full containers	7,339	
2	Container capacity (gallon per container)	55	
3	Unit cost for disposal ($ per gallon)	4.54	
4	Unit cost for disposal ($ per container)	(H.2 X H.3) =	249.70
5	Total Transport & Disposal cost	[H.1 x (H.4+A.4)] =	**$1,981,806.01**
I.	ALTERNATIVE FUELS (BULK SLUDGE) - CONTAINER DISPOSAL COST		
1	Total number of full containers (drums)	7,339	
2	Container capacity (gallon per container)	55	
3	Unit cost for disposal ($ per gallon)	1.88	
4	Unit cost for disposal ($ per container)	(I.2 X I.3) =	103.40
5	Total Transport & Disposal cost	[I.1 x (I.4 + B.4)] =	**$929,354.59**
J.	ALTERNATIVE FUELS - CONTAINER DISPOSAL COST		
1	Total number of full containers (drums)	7,339	
2	Container capacity (gallon per container)	55	
3	Unit cost for disposal ($ per gallon)	0.12	
4	Unit cost for disposal ($ per container)	(J.2 X J.3) =	6.60
5	Total Transport & Disposal cost	[J.1 x (J.4 + C.4)] =	**$110,054.67**
HAZARDOUS WASTE TANK DISPOSAL COSTS			
K.	ALTERNATIVE FUELS - TANK TRUCK WASTE DISPOSAL UNIT COST		
1	Total blended liquids disposal quantity (gallon)	275,550	
2	Unit cost for disposal ($ per gallon)	0.12	
4	Total Transport & Disposal cost	[K.1 x (K.2 + D.4)] =	**$93,135.90**
L.	DESTRUCTIVE INCINERATION - TANK TRUCK WASTE DISPOSAL UNIT COST		
1	Total sludge disposal quantity (gallon)	89,850	
2	Unit cost for disposal ($ per gallon)	1.25	
3	Total Transport & Disposal cost	[L.1 X (L.2 + E.4)] =	**$141,064.50**
OTHER OFF-SITE HAZARDOUS WASTE DISPOSAL			
M.	DECON WATER DISPOSAL UNIT COST[5]		
1	Total rinse water disposal quantity (gallon)	929,233	
2	Off-site disposal unit cost ($ per gallon)	0.45	
3	Total Transport & Disposal cost	[M.1 x (M.2 + F.4)] =	**$550,105.71**
N.	HAZARDOUS WASTE LANDFILL - CONTAINER DISPOSAL COST		
1	Total number of full containers (drums)	4	
2	Container capacity (gallon per container)	55	
3	Unit cost for disposal ($ per gallon)	1.21	
4	Unit cost for disposal ($ per container)	(I.2 X I.3) =	66.55
5	Total Transport & Disposal cost	[N.1 x (N.4 + G.4)] =	**$2,912.20**

NOTES (Continued):

5. Total Decontamination Water attributable to the Thermal Metal Wash (TMW) Unit = 156,228 gallons, at a total transportation and disposal cost of $92,487.13.

APPENDIX J-III-F
ON-SITE CLOSURE ACTIVITIES: COST ESTIMATE SUMMARY

CONTAINERS	%	# OF 55 GALLON CONTAINERS	COST PER DRUM ($)	COSTS ($)
Fuels	33.33%	7,339	22.29	163,596
Fuels (Bulk Sludge)	33.33%	7,339	19.60	143,853
Destructive Incineration (Containers)	33.33%	7,339	12.19	89,480
SUBTOTAL CONTAINERS	100%	22,018		396,929
TANKS	%	GALLONS	COST PER GALLON ($)	COSTS ($)
Fuels	75%	275,550	0.14	37,766
Fuels (Sludge)	25%	89,850	0.08	6,986
SUBTOTAL TANKS				44,753
DECONTAMINATION OF CONTAINER, TANK STORAGE & PROCESS EQUIPMENT CONTAINMENT AREAS ($)[1]				98,286
DECONTAMINATION OF TANKS AND ANCILLARY EQUIPMENT ($)[1]				78,214
DECONTAMINATION OF PROCESS EQUIPMENT (NON-TMW) ($)				13,213
DISMANTLING OF EQUIPMENT (NON-TMW) ($)				191,151
CERTIFICATION OF FINAL CLOSURE (NON-TMW) ($)				41,647
DECONTAMINATION OF TMW CONTAINMENT AREA ($)				5,942
TMW EQUIPMENT DECONTAMINATION ($)				50,496
DISMANTLING OF TMW EQUIPMENT ($)				54,011
CERTIFICATION OF TMW UNIT CLOSURE ($)				9,223
TOTAL ON-SITE CLOSURE COST ESTIMATE				983,864

[1] Includes Collection Tank T-401, Ancillary Equipment & Containment Area;
TMW Heat Exchangers Included in TMW Equipment Closure Costs

APPPENDIX J-III-H
(Thermal Metal Wash System Only)

WORKSHEET TMW-1

DECONTAMINATION OF TMW CONTAINMENT AREA

Protective clothing and safety equipment for facility personnel		
# of personnel requiring PPE*	5	
Personnel protective clothing unit cost ($/person)	95.09	
Safety equipment and protective clothing cost ($)		475.45
*PPE - Personnel protective equipment		
Containment Area Decontamination		
Includes Secondary Containment Steel by Steam Cleaning		
Building 400 (105' x 104') - (63*19) - (14.33*31)	9,279	
Total Pad Area (SF)	9,279	
(NOTE: See Appendix J-III-G, Worksheet A-4 for Closure of Tank T-401 & Tank Containment Area)		
Equipment rental unit cost ($/hr)	4.26	
Equipment unit operating cost ($/hr)	0.99	
Unit labor cost ($/hr)	25.00	
Pad decontamination cleaning rate (ft2/hr)	75.00	
Number of hours to clean pads (hrs)	124	
Unit cost per hour to clean pad ($/hr)	30.24	
Total labor and equipment to decontaminate pads ($)		3,741.54
Residual generation rate (gal/ft2)	4	
Total residual generated (gal)	37,116	
Testing for success of decontamination		
Number of samples required	2	
Sample collection time (hrs/sample)	0.5	
Sampling technician unit labor cost ($/hr)	25.00	
Sample collection time (hrs)	1.0	
Sampling cost ($)	25.00	
Unit cost of analysis ($/sample)	850.00	
Total cost of testing for success of decontamination ($)		1,725.00
TOTAL COST OF DECONTAMINATION OF TMW CONTAINMENT AREA ($)		5,941.99

WORKSHEET TMW-2

DECONTAMINATION OF TMW EQUIPMENT

Protective clothing and safety equipment for facility personnel		
# of personnel requiring PPE*	4	
Personnel protective clothing unit cost ($/person)	95.09	
Safety equipment and protective clothing cost ($)		380.36
*PPE - Personnel protective equipment		
Equipment Decontamination:		
Includes Piping & Equipment (Valves, Pumps Feed lines & Filters)		
Piping & Ancillary Equipment Decontamination		
Number of pumps & filters	13	
Total number of feet of feed lines - 12" (ft)	50	
Total number of feet of feed lines - 8" (ft)	40	
Total number of feet of feed lines - 6" (ft)	200	
Total number of feet of feed lines - 4" (ft)	20	
Total number of feet of feed lines - 3" (ft)	1,670	
Total number of feet of feed lines - 2" (ft)	0	
Total number of feet of feed lines 1" (ft)	506	
# of hours to flush lines (4 hrs/50 ft) (hrs)	199	
# of hours to decontaminate pumps & filters (4 hrs/pump)	52	
Total hours to decontaminate pumps, filters & lines (hrs)	251	
Total labor cost @ $25.00/hr	6,272.00	
# of bags of caustic for line decon. (1 bag/200 gal)	27	
Cost of caustic @ $33.28/bag	888.07	
Cost of fresh rinse water ($1.45/1000 gal)	7.74	
Total for line & pump decontamination ($)		7,167.81
Residual generated from 12" line and pump cleaning (gal)	1,188	
Residual generated from 8" line and pump cleaning (gal)	422	
Residual generated from 6" line and pump cleaning (gal)	1,188	
Residual generated from 4" line and pump cleaning (gal)	53	
Residual generated from 3" line and pump cleaning (gal)	2,405	
Residual generated from 2" line and pump cleaning (gal)	0	
Residual generated from 1" line and pump cleaning (gal)	81	
Total residual generated - line and pump cleaning (gal)	5,337	
TMW Equipment Decontamination		
# of people entering tanks	4	
Additional PPE unit cost ($/person)	205.00	
Additional safety equipment cost ($)	820.00	
Method of decontamination - steam cleaning		
Equipment surface area to be decontaminated (ft2)	28,444	
Equipment rental cost ($/hr)	4.255	
Equipment operating cost ($/hr)	0.9866	
Unit labor cost ($/hr)	25.00	
Cleaning rate (ft2/hr)	50	
# of hours to clean equipment	569	
Unit cost to clean equipment ($/hr)	30.24	
Total labor and equipment cost ($)	18,023.74	
Surcharge factor (2.0)	2	
Total TMW equipment decontamination cost ($)		36,047.47
Residual generation rate (gal/ft2)	4	
Total residual generated from equipment cleaning (gal)	113,775	
Off-site Treatment of Decontamination Residual		
Total volume of residual generated (gal)	119,112	

APPPENDIX J-III-H
(Thermal Metal Wash System Only)

<u>Testing for Success of Decontamination</u>		
Number of samples required	8	
Sample collection time (hrs/sample)	0.5	
Sampling technician unit labor cost ($/hr)	25.00	
Sample collection time (hrs)	4	
Sampling cost ($)	100.00	
Unit cost of analysis ($/sample)	850.00	
Total cost of testing for success of decontamination ($)		6,900.00
<u>TOTAL TMW EQUIPMENT DECONTAMINATION COST ($)</u>		<u>50,495.64</u>

APPPENDIX J-III-H
(Thermal Metal Wash System Only)

WORKSHEET TMW-3

REMOVAL OF TMW PROCESS & ANCILLARY EQUIPMENT & FLOOR PLATES

Equipment Dismantling:
Includes Piping, Process Equipment & Steel Secondary Containment

Process equipment - ft2 to be cut	28,444	
Number of ft2/hr (5' x 5' sheets)	18.75	
# of hours to cut process equipment (hrs)	1,517	
Unit labor cost ($/hr)	25.00	
Weeks to complete process equipment dismantling (wks)	3.0	
Boom lift rental (2) ($1783/mo)	3566.00	
Forklift rental (2) ($595/mo)	1190.00	
Cutting torches rental ($/hr)	0.02734	
Total for process equipment dismantling ($)		42,722.58
Floor steel plate - ft2 to be cut	9,279	
Number of ft2/hr (5' x 5' sheets) (hrs)	31.25	
# of hours to cut floor plates (hrs)	297	
Unit labor cost ($/hr)	25.00	
Weeks to complete floor plate dismantling (wks)	2	
Forklift rental (2) ($595/mo)	1190.00	
Cutting torches rental ($/hr)	0.02734	
Total for floor plate dismantling ($)		8,621.32
Ancillary equipment to be dismantled - ft to be cut	2,486	
Number of ft/hours (5' sections) (hrs)	30	
# of hours to cut pipes (hrs)	83	
Unit labor cost ($/hr)	25.00	
Weeks to complete ancillary equipment dismantling (wks)	2.8	
Total for ancillary equipment dismantling ($)		2,071.67
Scrap metal removal ($) credit not allowed	0.00	
Mobilization of rental equipment	595.00	
Total mobilization and removal of scrap metal ($)		595.00
TOTAL COST FOR DISMANTLING OF EQUIPMENT ($)		54,010.56

WORKSHEET TMW-4

CERTIFICATION FOR TMW UNIT CLOSURE

Independent Registered Professional Engineer		
Initial review of closure plan (hrs)	6	
Inspection frequency (Inspections/week)	1	
Inspection time required (hrs/inspection)	4	
# of weeks for closure	8	
Inspection time required (hrs)	38	
Preparation of final closure document (hrs)	24	
Total professional engineer time required (hrs)	62	
Professional engineer unit labor cost ($/hr)	110.00	
Professional engineer cost ($)		6,820.00
Soil Testing for Verification of Clean Closure		
Number of samples required	2	
Sample collection time (hrs/sample)	0.5	
Sampling technician unit labor cost ($/hr)	25.00	
Sample collection time (hrs)	1.0	
Sampling cost ($)	25.00	
Unit cost of analysis ($/sample)	1,189.00	
Total cost of soil testing for verification ($)		2,403.00
TOTAL COST FOR CERTIFICATION OF CLOSURE ($)		9,223.00

APPENDIX J-III-H
TMW Table J-III-5
TMW Equipment Surface Area

Item No.	Equipment Description	Component	Exterior Surface Area (sq ft)	Interior Surface Area (sq ft)	Misc Surface Factor 15% (sq ft)	Unit Area (sq ft)	Total Area (sq ft)
1	Feed Hopper	Hood	224	224	67	515	
		Hood Steel Support	700	0	105	805	**1,320**
2	Feed Screws	4 Screw Live Bottom	240	390	95	725	
		1 Transfer Screw	72	136	31	239	**964**
3	Hot Oil Screw	Trough	646	646	194	1,485	
		Screws	377	283	99	759	
		Hoods	185	185	56	426	
		Stand/Support	306	0	46	352	**3,021**
4	Electric Heat Screw	Trough	446	446	134	1,025	
		Screws	251	188	66	506	
		Hoods	62	62	19	142	
		Stand/Support	164	0	25	189	**1,861**
5	Cooling Screw 1	Trough/Cover	224	224	67	515	
		Screw	203	70	41	315	
		Hood/Transition	28	28	8	64	
		Stand/Support	164	0	25	189	**1,083**
6	Cooling Screw 2	Trough/Cover	224	224	67	515	
		Screw	203	70	41	315	
		Divert Gate/Trans	102	102	31	235	
		Stand/Support	164	0	25	189	**1,253**
7	Drag Conveyor 1	Top Trough	174	174	52	399	
		Boot Casing	116	116	35	266	
		Head Casing	74	74	22	169	
		Return Trough	174	174	52	399	
		Chain	440	0	66	506	
		Supports	160	0	24	184	
		Hood/Transition	28	28	8	64	**1,988**
8	Deck Screen	Top Cover	41	41	12	93	
		Sides	143	143	43	328	
		Decks	81	81	24	186	
		Hood/Transition	28	28	8	64	**672**
9	Char Conveyor 1	Transition Hood	26	26	8	60	
		Top Enclosed Hood	110	110	33	253	
		Bottom Hood	110	110	33	253	
		Conveyor	78	0	12	90	
		Conveyor Components	400	0	60	460	
		Char Magnet	340	680	153	1,173	
		Discharge Chutes	96	96	29	221	
		Support Steel	164	0	25	189	**2,698**
10	Char Conveyor 2	Transition Hood	26	26	8	60	
		Top Enclosed Hood	110	110	33	253	
		Bottom Hood	110	110	33	253	
		Conveyor	78	0	12	90	
		Conveyor Components	400	0	60	460	
		Overs Magnet	548	1,096	247	1,891	
		Discharge Chutes	144	144	43	331	
		Support Steel	225	0	34	259	**3,597**
11	Drag Conveyor 2	Top Trough	174	174	52	399	
		Boot Casing	116	116	35	266	
		Head Casing	74	74	22	169	
		Return Trough	174	174	52	399	
		Chain	440	0	66	506	
		Supports	160	0	24	184	
		Hood/Transition	28	28	8	64	**1,988**
12	Venturi 1	Venturi	20	20	6	45	
		Inlet	25	25	8	58	
		Reservoir	64	64	19	147	**250**
13	Venturi 2	Venturi	20	20	6	45	
		Inlet	25	25	8	58	
		Reservoir	64	64	19	147	**250**

APPENDIX J-III-H
TMW Table J-III-5
TMW Equipment Surface Area

Item No.	Equipment Description	Component	Exterior Surface Area (sq ft)	Interior Surface Area (sq ft)	Misc Surface Factor 15% (sq ft)	Unit Area (sq ft)	Total Area (sq ft)
14	Venturi 3	Venturi	20	20	6	45	
		Inlet	25	25	8	58	
		Reservoir	48	48	14	110	**213**
15	Venturi 4	Venturi	20	20	6	45	
		Inlet	25	25	8	58	
		Reservoir	64	64	19	147	**250**
16	Venturi 5	Venturi	20	20	6	45	
		Inlet	25	25	8	58	
		Reservoir	48	48	14	110	
		Cyclone	30	30	9	69	**282**
17	Venturi 6	Venturi	20	20	6	45	
		Inlet	25	25	8	58	
		Reservoir	54	54	16	124	
		Cyclone	30	30	9	69	
		Demister	104	104	31	238	**534**
18	Heat Exchanger 1	External (no plates)	126	0	19	145	
		Internals (plates)		342	51	393	**538**
19	Heat Exchanger 2	External (no plates)	126	0	19	145	
		Internals (plates)		342	51	393	**538**
20	Heat Exchanger 3	External (no plates)	126	0	19	145	
		Internals (plates)		342	51	393	**538**
21	Heat Exchanger 4	External (no plates)	126	0	19	145	
		Internals (plates)		342	51	393	**538**
22	Heat Exchanger 5	External (no plates)	126	0	19	145	
		Internals (plates)		342	51	393	**538**
23	Heat Exchanger 6	External (no plates)	126	0	19	145	
		Internals (plates)		342	51	393	**538**
24	Heat Exchanger 7	External (no plates)	126	0	19	145	
		Internals (plates)		342	51	393	**538**
25	Wet Dust Collector	Wet Dust Collector	176	192	55	423	
		Internals (plates)	21	21	6	49	**472**
26	TOU-102	Internal Wall (Cylinder)	NA	748	NA	748	
		Interior Bottom		38	NA	38	786
27	TOU-103	Internal Wall (Cylinder)	NA	1,131	NA	1,131	
		Interior Bottom		64	NA	64	**1,195**
				Total TMW Equipment Surface Area =			28,444

APPENDIX J-III-G

Table J-III-6

TMW Pipe Length Flushing Calculations

Item No.	Description	Component	Diameter (in)	Length (ft)	Total Lineal Feet by Pipe Dia.						
			Pipe Diameter =		12	8	6	4	3	2	1
1	Piping at V1	Vent Piping to V6 Header	8	12		12					
		Spray Piping Into V1	3	95					95		
		Discharge Piping to Pump & H/X	3	120					120		
			1	30							30
		Misc Pipe Fittings (Strainers, etc.)									
2	Piping at V2	Vent Piping to V6 Header	8	12		12					
		Spray Piping Into V2	3	110					110		
		Discharge Piping to Pump & H/X	3	136					136		
			1	30							30
		Misc Pipe Fittings (Strainers, etc.)									
3	Piping at V3	Vent Piping to V6 Header	8	8		8					
		Spray Piping Into V3	3	124					124		
		Discharge Piping to Pump & H/X	3	150					150		
			1	30							30
		Misc Pipe Fittings (Strainers, etc.)									
4	Piping at V4	Vent Piping to V6 Header	8	8		8					
		Spray Piping Into V4	3	136					136		
		Makeup Liquid Piping	1	84							84
		Discharge Piping to Pump & H/X	3	164					164		
			1	30							30
		Misc Pipe Fittings (Strainers, etc.)									
5	Piping at V5	Vent Piping to Blower/TOU Header	3	32					32		
			6	200			200				
		Vent Piping from Wet Dust Collector	3	54					54		
		Spray Piping Into V7	3	32					32		
		Makeup Liquid Piping	1	24							24
		Discharge Piping to Pump & H/X	1	124							124
		Spray piping into Cooling Screw 1	1	124							124
		Misc Pipe Fittings (Strainers, etc.)									
6	Piping at V6	Vent Piping to Tou Header	3	200					200		
		Vent Piping from V1-V4	12	50	50						
		Spray Piping Into V6	3	95					95		
		Discharge Piping to Pump & H/X	3	120					120		
			1	30							30
		Misc Pipe Fittings (Strainers, etc.)									

APPENDIX J-III-G
Table J-III-6
TMW Pipe Length Flushing Calculations

Item No.	Description	Component	Diameter (in)	Length (ft)	Total Lineal Feet by Pipe Dia.						
			Pipe Diameter =		12	8	6	4	3	2	1
7	Piping at Wet Dust Collector	Vent Piping from Magnets	3	90					90		
		Vent Piping from Conveyor	3	12					12		
		Discharge Piping to Char Conveyor	4	20				20			

	12	8	6	4	3	2	1
Total TMW Piping Lengths per Diameter =	50	40	200	20	1670	0	506
Pipe Diameter	12	8	6	4	3	2	1
Pipe X-Section Area	113.1	50.265	28.274	12.566	7.0686	3.1416	0.7854
Gallons per Flush	297	132	74.25	33	18	8	2
# of Flushes	4	4	4	4	4	4	4
Gallons per 50' of Pipeline	1188	528	297	132	72	32	8